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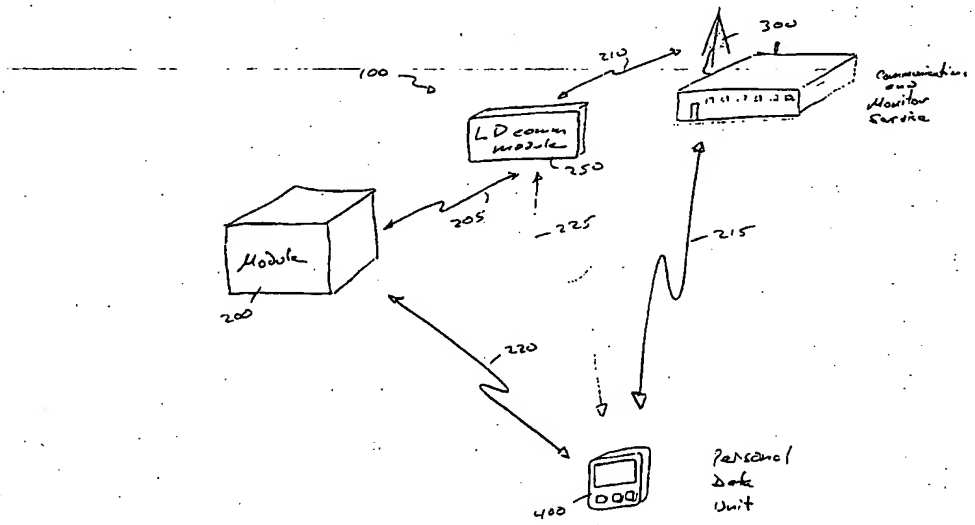
(54) Title: MODULAR COMMUNICATION AND CONTROL SYSTEM AND METHOD



(57) Abstract: A system and method for detecting and monitoring at least one event or condition of interest. The system comprises a sensor and a wireless transmitter and receiver (150). Upon detection of an event of interest, the sensor communicates that information to the transmitter for communication to the receiver. A module with a sensor to indicate the position of a door coupled to a door opener. The module (200) is compatible with a wireless communication protocol and operates over both a long range, such as is used with a cellular telephone, and a short range, such as is used with BLUETOOTH. A door position sensor coupled to the module (200) provides information to the user over a wireless communication channel. In one embodiment, information from an additional door position sensor is wirelessly transmitted. In one embodiment, an audio transducer coupled to the module responds to voice commands to operate the door opener.

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MODULAR COMMUNICATION AND CONTROL SYSTEM AND METHOD

Field of the Invention

The present subject matter relates generally to communication and control systems, and in particular, to a wireless, modular, system suitable for a variety of applications, including building maintenance and control, premises security and personal safety.

Background of the Invention

The variety of separate networks that may exist in a single building creates numerous problems for those purchasing, operating, and maintaining those networks. One example of a typical network is a security system. Another network is a building management or environmental control system. Each of these networks operates using separate controllers, separate network elements, and separate power supplies. With few exceptions, the intranetwork communications of one system are not compatible with those of another system. In addition, the design and installation of such systems are usually proprietary and thus, components from one manufacturer are not compatible with those of another manufacturer. Furthermore, the bandwidth requirements for the communications within each type of network are varied. For example, a security system may require a bandwidth of approximately 1kbit/second, whereas a building management system may require 100kbit/second.

What is needed in the art is improved technology that enables portable, modular, bidirectional communication between a wide variety of devices and that satisfies the demand for a security systems and automated building controls.

Furthermore, what is needed in the art is a system enabling both safety and convenience features in an affordable, modular, arrangement that is easy to install and manage.

In addition, and for reasons of convenience and safety, many overhead garage doors are equipped with an electric door opener. Automobile drivers find it convenient to remotely open and close the overhead door without exiting their car. Homeowners also enjoy the convenience of opening the garage door with a push of a button. Often, a control button is wired directly to the opener and located on an interior surface of a garage wall. Homeowners also find that a properly installed electric garage door opener improves personal safety. Most doors are heavy and, unless operated with appropriate care, can be lethal if dropped on a child. Safety features of modern garage doors, including automatic reverse on obstruction and floor level optical sensors, provide some measure of protection against crushing a person.

However the typical garage door opener suffers from a number of problems. First, garage door openers lack any feedback to indicate the position of the door to the user. Unless the user observes complete closure of the door, there remains the possibility that the door will return to an open position after the user has driven out of view. For example, if a cat runs out of the garage moments before complete closure or if a broom handle falls in the path of the door, the opener will return the door to an open position. An unattended home with an open garage door is an easy target for a burglar. Second, in most cases, the user must use either the proprietary remote control encoded for use with the particular opener or the wired button usually affixed to a wall surface. If the remote control is unavailable, then the user is inconvenienced and forced to use other means to open the door. For example, without a remote control, the user may have to enter the garage using an alternate door or use an external switch. Third, typical garage door openers lack adequate security protection to prevent operation of the door by an unauthorized person. For example, in some cases, the wireless garage door opener access code can be stolen by a third party using code grabbing devices. Using such a device, a thief waiting near the home can copy the wireless access code and later return to burglarize the garage, and in some cases, the home.

A profile schematic of a residential garage door opener system 1000 is illustrated in Figure 30. In the figure, power unit 1500 may include an electric

motor that provides the force to open and close the garage door. Power unit 1500 may include a belt drive, a chain drive, gear train or other power transmission means to convert rotational forces to linear motion. In the typical installation, power unit 1500 is anchored securely to rafters or other ceiling structure in the garage by supporting structure 5500, which may include angle iron or other stock.

Trolley mechanism 2500 travels along track 2000 in the directions shown generally by arrow 5000. Track 2000 is attached at one end to power unit 1500 and attached at the other end to the garage structure at bracket 4500. Actuator arm 3000 is flexibly coupled to trolley 2500 on one end and flexibly coupled to garage door 4000 by bracket 3500. Door 4000 may be fabricated of wood, aluminum, steel, fiberglass or any other material and often includes multiple door panels, each of which is commonly referred to as a section, arranged in a hinged assembly. A section of door is illustrated in Figure 30. The edge of each section of garage door 4000 includes rollers. The rollers engage door tracks mounted along the sides of the door opening.

Switch 6500 is wired directly to power unit 1500 by line 7000. Switch 6500 is often mounted on a wall adjacent to a service door to the garage. Normally, when the button on switch 6500 is pressed, power unit 1500 drives door 4000 to an open position if door 4000 closed, and to a closed position if open. Electrical power to operate in this manner is drawn from line cord 6000 which is typically plugged into a nearby outlet mounted in the ceiling of the garage.

In addition to switch 6500, power unit 1500 can be operated by using remote control 8500. Control 8500 includes a wireless transmitter that broadcasts a signal to power unit 1500 by radio link 8000. In the figure, antenna 7500 is mounted on power unit 1500, however, an antenna may, instead, be located on switch 6500. Control 8500 is most often used by a driver from within an automobile. Control 8500, like switch 6500, causes power unit 1500 to drive door 4000 to an open position if closed, and to a closed position if door 4000 is open.

For the reasons stated above, and for other reasons stated below which will become apparent to those skilled in the art upon reading and understanding the present specification, there is a need in the art for systems and methods to control and manage a door opener system or other device using a controller having an unlimited geographical range, interoperability with other systems, simple programming to enable easy set-up and configuration of the remote control system, and feedback indicating status or mode of operation of the opener or other device.

Summary

The present subject matter provides a system and method to address the aforementioned problems. In one embodiment, the present subject matter provides a security sensor and a wireless transceiver communicating using a network protocol. In one embodiment, the transceiver also retransmits communications using the network protocol. In various embodiments, the transceiver is compatible with an IEEE specification, BLUETOOTH® technical specification 1.0. The sensor may include, but is not limited to, a motion sensor, a passive infrared motion detector, pressure sensor, position sensor, proximity sensor, glass breakage sensor or a video camera. Environmental sensors are also contemplated, either individually or in combination with other sensors. Environmental sensors may include, but are not limited to, a temperature sensor, a gas sensor, a particulate sensor, a fluid sensor, or a sound sensor. The system may also include a control, such as, but not limited to a power control, an appliance control, an air conditioner control, a furnace control, or a ventilation control. The system may also include a an operable security device coupled to the wireless transceiver. Such devices may include, but are not limited to, a lock or a siren. In one embodiment, other wireless transceivers are comprehended and enable relaying of communications. In one embodiment, the wireless transceiver communicates with a long range, bidirectional wireless network, such as, but not limited to, a telephone, a cellular telephone, a pager, a computer, a personal communication service (PCS) device, a narrowband PCS device, a two-way pager, a personal data assistant. The system may be battery powered or powered by metered electric service.

In one embodiment, the system includes a security device, and a first wireless transceiver electrically coupled to the security device, wherein the first wireless transceiver monitors a plurality of radio frequencies, retransmits digital data in a digital network protocol, receives outbound data from the security device and wirelessly transmits the outbound data using the digital network protocol. Furthermore, the transceiver may be adapted for wirelessly receiving incoming digital data in the network protocol and communicating the incoming digital data to the security device. One embodiment includes a second wireless transceiver in communication with the first wireless transceiver, the second wireless transceiver adapted for monitoring the plurality of radio frequencies, receiving and retransmitting digital data in the digital network protocol, communicating outgoing data to a user, and transmitting the incoming digital data. In one embodiment, the transceiver is a spread spectrum transceiver. Either transceiver may be compatible with standards under IEEE 802.15, or compatible with BLUETOOTH® technical specification version 1.0. In one embodiment, the second wireless transceiver is electrically coupled to a user controllable communication device. In one embodiment, the user controllable communication device is in communication with a user. In various embodiments, the second wireless transceiver is coupled to a telephone line, a long range transceiver, a cellular communication network, or a narrowband personal communication system network. In one embodiment, the system is coupled to a modem or a packetized communication network, such as the Internet. Various portions of the system may be battery powered or line voltage powered.

In one embodiment, the system includes a first module and a second module. The first module may include a microprocessor controller, a lock coupled to the controller, an audio transducer coupled to the controller, the audio transducer for generating an electrical signal in response to received audio and for generating audio in response to a received electrical signal, a caller accessible identification module coupled to the controller, the caller accessible identification module for receiving caller entered information, a proximity detector coupled to the controller, the proximity detector for signaling the

presence of a caller near the exterior module; and a first wireless transceiver coupled to the controller, the first wireless transceiver transmitting a digital signal received from the controller, the first wireless transceiver monitoring a radio frequency for an incoming digital message in a network protocol and for communicating digital data in the network protocol upon receiving an incoming digital message. The second module may include a second wireless transceiver in wireless communication with the first wireless transceiver, the second wireless transceiver monitoring a radio frequency for an incoming digital message in a network protocol and for communicating digital data in the network protocol upon receiving an incoming digital message and a user accessible control panel electrically coupled to the second wireless transceiver. In one embodiment, the audio transducer comprises a speaker and a microphone. In one embodiment, the first module includes a video camera and the second module includes a video display. In one embodiment, the proximity detector comprises a doorbell button or a video camera. In one embodiment, the user accessible identification module includes a keypad, a biometrics sensor, or a card reader.

In one embodiment, the system comprises a clock and a transceiver coupled to the clock and a first control accessible to the user and coupled to the transceiver, wherein actuation of the first control effectuates one of a plurality of user-selectable outputs, the user-selectable outputs each coupled wirelessly to the device, and a second control accessible to the user, wherein actuation of the second control selects a time for activating the one of a plurality of user selectable outputs. In one embodiment, the outputs activate a security system or controls an environmental control, or controls a premises control. In one embodiment, the user can select an absolute time, a time relative to a predetermined time, or a default time. In one embodiment, the transceiver communicates omnidirectionally and is adapted for ad hoc networking capability.

In one embodiment, the present subject matter describes a method including receiving a request for service from a caller using an annunciator module, transmitting the request as a digital message in a wireless, premises-

based network protocol, receiving the request at a remote location using a personal communication device, and notifying a user of the device of the received request. In one embodiment, the method includes acknowledging receipt of the signal and communicating between the module and the device. In one embodiment, the method includes communicating a video image between the module and the device. In one embodiment, the method includes sending an executable command from the device, receiving the executable command at the module, and executing the instruction. In one embodiment, the method includes sending an executable command to operate a door lock.

In one embodiment, the method includes entering a predetermined code into a portable transmitter, transmitting the code as a digital message in a wireless, premises-based network protocol, receiving the code at a receiver coupled to an operable device, verifying authorization of the transmitted code, and operating the device. In one embodiment, the method includes unlocking a door lock or operating an electric light.

In one embodiment, the method includes detecting the position of a bolt, transmitting information corresponding to the detected position using a wireless radio frequency link in a digital, premises-based network protocol, receiving the transmitted information, and operating a security system as a function of the received information. In one embodiment, the method includes operating perimeter sensors when the bolt is detected in a first position and operating perimeter sensors and interior sensors when the bolt is detected in a second position. In one embodiment, the method includes operating a security system as a function of the bolt position and the detected video image.

In one embodiment, the method includes executing programming on a portable communication device, generating a visual display of options for controlling the security system, selecting operational parameters for the security system using the display, executing a command to implement the selected operational parameters, and transmitting the command and selected parameters to the security system using a wireless radio frequency link in a digital, premises-based network protocol.

In one embodiment, a system includes a transducer for generating data upon detecting a local event, a first communication module coupled to the transducer, the first communication module including a first transceiver for wirelessly transmitting transducer data in a premises-based, digital network protocol, and a second communication module for wirelessly communicating with the first communication module, the second communication module further including a second transceiver for communicating with the first communication module using the digital network protocol, and a user operable device coupled to the second transceiver, the user operable device adapted for communicating with the transducer via the digital network protocol. In one embodiment, a controllable member is operated as a function of the user operable device.

In one embodiment, the method includes detecting a user controlled action, generating encoded data as a function of the user controlled action, transmitting the encoded data to a remote facility using a premises-based, digital network protocol, receiving the encoded data at the remote facility, and initiating an emergency response as a function of the encoded data. In one embodiment, the method includes summoning fire suppression aid, summoning police service or summoning medical aid. In one embodiment, the method includes detecting a keystroke, detecting a touch screen input or detecting an audible command. In one embodiment, the method includes generating encoded data indicative of a fire emergency, a police emergency, or a medical emergency. - -

In one embodiment, the system includes a passive infrared motion detector and a transmitter coupled to the detector, the transmitter is compatible with BLUETOOTH® technical specification version 1.0. In one embodiment, the system includes a receiver coupled to the detector, the receiver is compatible with BLUETOOTH® technical specification version 1.0. In one embodiment, the system includes a long range communication module, the module adapted for communicating with the detector using the transmitter and further wherein the module is coupled to a long range communication network. In one embodiment, the long range communication network is a telephone network, a cellular telephone network, a radio network, a personal communication system network, or a two-way pager network.

In addition, the above mentioned problems with door openers and other problems are addressed by the present invention and which will be understood by reading and studying the following specification. A system and method is described which allows remote control and management of single or multiple door openers using a wired or wireless communication device. The device may be a cellular telephone, a pager, a personal digital assistant, a computer or other device that communicates using a network.

In particular, an illustrative embodiment of the present invention includes a processor executing programming and coupled to a door opener, a position sensor, and a wireless transceiver that communicates using both a long range communication protocol and a short range communication protocol. A user need not specify the communication protocol to be used in controlling or managing the opener. The opener receives commands and transmits status information using either or both of the long range and short range protocols. In one embodiment, the system detects the presence of a short range protocol device, disables long range communications, and engages in short range communications with the detected device. When the distance between the device and the door opener exceeds the effective range of the short range device, the system terminates short range communications and establishes a communication link using a long range communication protocol. The communication link, whether long range or short range, provides a channel for communicating information from the door opener to the device and for communicating instructions from the device to the door opener.

Position information is transmitted to the device by a transceiver coupled to the processor. Other information, such as temperature or light levels, may also be transmitted to the device.

The present subject matter provides a system and method to address the aforementioned problems and others not expressly stated in this detailed description. In one embodiment, an assisted personal communication system, including a two way pager or other bidirectional, long range, communication device, is used in conjunction with a response agency to coordinate a request for assistance by a user. In one embodiment, the system is used for children to

report an emergency, or other situation, and to coordinate assistance efforts by the response agency.

These and other features and advantages of the invention will become apparent from the following description of the embodiments of the invention.

Description of the Figures

Figure 1 is a diagram showing one embodiment of the present system.

Figure 2A is a diagram showing one embodiment of the present system.

Figure 2B is a diagram showing one embodiment of the present system.

Figure 2C is a diagram showing one embodiment of the present system.

Figure 2D is a diagram showing one embodiment of the present system.

Figure 3A is a diagram showing the operation of one embodiment of the long distance communication module.

Figure 3B is a diagram showing the operation of one embodiment of the long distance communication module.

Figure 3C is a diagram showing the operation of one embodiment of the long distance communication module.

Figure 3D is a diagram showing the operation of one embodiment of the long distance communication module.

Figure 4 is a diagram showing various modes of communication with one embodiment of the present system.

Figure 5 is a diagram showing communication routes within one embodiment of the present system.

Figure 6A is a diagram showing one embodiment of a personal detection unit.

Figure 6B is a diagram showing one embodiment of a personal detection unit.

Figure 6C is a diagram showing one embodiment of a personal detection unit.

Figure 6D is a diagram showing one embodiment of a personal detection unit.

Figure 7 is an isometric view of an entry door with one embodiment of the present system.

Figure 8 is a top view of an entry door with one embodiment of the present system.

Figure 9 is an isometric view of one embodiment of the present system.

Figure 10 is an isometric view of one embodiment of the present system.

Figure 11 is a diagram of one embodiment of the present system.

Figure 12 is a diagram of a portion of one embodiment of the present system.

Figure 13 is an isometric view of one embodiment of the present system.

Figure 14 is a view of one embodiment of the present system.

Figure 15 is an isometric view of one embodiment of the present system.

Figure 16 is an isometric view of a portion of one embodiment of the present system.

Figure 17 is an isometric view of one embodiment of the present system.

Figure 18 is an isometric view of one embodiment of the present system.

Figure 19 is an isometric view of one embodiment of the present system.

Figure 20 is an isometric view of one embodiment of the present system.

Figure 21 is an isometric view of one embodiment of the present system.

Figure 22 is an isometric view of one embodiment of the present system.

Figure 23 is an isometric view of one embodiment of the present system.

Figure 24 is an isometric view of one embodiment of the present system.

Figure 25 is an isometric view of one embodiment of the present system.

Figure 26 is an organizational chart depicting typical applications of a modular communication system.

Figure 27 is a diagram of one embodiment of the present system with various modes of operation.

Figure 28 is an isometric view of a computer incorporating one embodiment of the present system.

Figure 29 is diagram depicting representative applications of a modular communication system.

Figure 30 schematically illustrates a residential garage door opener.

Figure 31 illustrates a block diagram of one embodiment of the present system.

Figure 32 illustrates one embodiment of a transceiver in accordance with one embodiment of the present system.

Figure 33 illustrates one embodiment of a transceiver in accordance with one embodiment of the present system.

Figure 34 illustrates one embodiment of a power supply in accordance with one embodiment of the present system.

Figure 35 illustrates one embodiment of a processor in accordance with one embodiment of the present system.

Figure 36 illustrates one embodiment of programming in accordance with one embodiment of the present system.

Figure 37 illustrates one embodiment of a method in accordance with one embodiment of the present system.

Detailed Description

This detailed description provides a number of different embodiments of the present system. The embodiments provided herein are not intended in an exclusive or limited sense, and variations may exist in organization, dimension, hardware, software, mechanical design and configuration without departing from the claimed invention, the scope of which is provided by the attached claims and equivalents thereof.

An embodiment of present system 100 is depicted in Figure 1 and includes module 200, long distance communication ("LD comm") module 250, communication and monitor service facility ("facility") 300, and personal data unit ("PDU") 400. Module 200 is in wireless communication with LD comm module 250 via link 215. LD comm module 250 is also in wireless communication with facility 300 via link 210 and in wireless communication with PDU 400 via link 225. Facility 300 is in communication with PDU 400 via link 215. In addition, module 200 is in wireless communication with PDU 400 via link 220 via link 220.

The operation of module 200, in one embodiment, is as follows. Module 200, in response to a sensed or detected condition, generates and wirelessly transmits digital data. The condition may include an event. The digital data may correspond to the magnitude of the condition or it may indicate that the event, or

condition, occurred. Other parameters or values of digital data are also possible. The digital data transmitted by module 200 is an omnidirectional broadcast signal. In the embodiment shown in Figure 1, the signal is communicated to LD comm module 250 by wireless link 205. LD comm module 250, in turn receives the digital data, or signal, and retransmits the signal on a long range communication channel. The long range communication channel may be an omnidirectional radio broadcast, a wired network or any other type of long range communication channel. In the embodiment shown, LD comm module 250 retransmits, or rebroadcasts the signal to facility 300 via wireless radio link 210. In other embodiments, the signal is rebroadcast via a land line, a satellite link, or a combination of links and such examples are exemplary of all links contemplated herein. Figure 1 also depicts LD comm module 250 in communication with PDU 400 via link 225. LD comm module 250, and thus, link 225, may communicate using a two-way pager network, in which case, PDU 400 is a two-way pager. Alternatively, PDU 400 receives communication from facility 300 using link 215.

Having received the digital data transmitted by module 200, PDU 400 displays or renders the information in a manner useful to a person carrying PDU 400. In one embodiment, PDU 400 provides an audible signal to a user. In one embodiment, PDU 400 generates and displays graphical or textual information for the benefit of a user. In one embodiment, PDU 400 generates a tactile signal.

One embodiment of the present system allows a user carrying PDU 400 to interact with module 200 using wireless links 205, 220, or 215. Additional features and functionality of system 100 are described below.

Figure 2A, 2B, 2C and 2D provide additional view of embodiments of module 200. As shown in the figures, module 200 includes two or more components. In Figure 2A, module 200 includes device 140A coupled to transceiver 150. Transceiver 150 includes a receiver and a transmitter to enable wireless communication with device 140A. In one embodiment, device 140A generates a signal that is coupled to transceiver 150. In one embodiment, device 140A responds to signals generated by transceiver 150.

Figure 2B depicts module 200 having transceiver 150 coupled to sensor 140B. In one embodiment, sensor 140B includes a security sensor such as a motion detector, a door position sensor, or a video camera. Sensor 140B, in one embodiment, includes an environmental sensor such as a temperature probe or gas detector. Sensor 140B may be an event detection sensor or parameter detection sensor. An event may include such discrete events as unauthorized intrusion, power failure, or fire. Parameters may relate to levels of gases or fluids, temperature, rate of change of temperature or any other measurable value. Examples of sensors include a video camera, a security system door or window contact, a gas detector (such as carbon monoxide), smoke detector, or audio microphone.

In Figure 2C, module 200 includes actuator 140C coupled to transceiver 150. Actuator 140C, in one embodiment, includes a solenoid actuator. Actuator 140C may include an operable component such as a transducer or other type of electromechanical device. An actuator may include a deadbolt or solenoid-type device, actuation of which results in a mechanical change in another apparatus. A transducer may include a siren, bell or other sounding device. Other types of actuators are also comprehended, including a sounding device or a relay. In Figure 2D, module 200 includes transceiver 150 coupled to sensor and actuator 140D. Sensor and actuator 140D, in one embodiment, includes a combination of a sensor and an actuator, as herein described. In the embodiment shown, transceiver 150 communicates with both elements of sensor and actuator 140D. In other words, transceiver 150 receives and transmits sensed information as well as operating an actuator.

Transceiver 150 of module 200, in one embodiment, is a wireless transceiver utilizing BLUETOOTH® communication technology. BLUETOOTH® is a trademark registered by Telefonaktiebolaget LM Ericsson of Stockholm, Sweden and refers to short range communication technology developed by an industry consortium known as the BLUETOOTH® Special Interest Group. BLUETOOTH® operates at a frequency of approximately 2.45GHz, utilizes a frequency hopping (on a plurality of frequencies), spread spectrum scheme, and provides a digital data transfer rate of approximately

1Mb/second. In one embodiment, the present system includes a transceiver in compliance with BLUETOOTH® technical specification version 1.0, herein incorporated by reference. In one embodiment, the present system includes a transceiver in compliance with standards established, or anticipated to be established, by the Institute of Electrical and Electronics Engineers, Inc., (IEEE). The IEEE 802.15 WPAN standard is anticipated to include the technology developed by the BLUETOOTH® Special Interest Group. WPAN refers to Wireless Personal Area Networks. The IEEE 802.15 WPAN standard is expected to define a standard for wireless communications within a personal operating space (POS) which encircles a person. In one embodiment, the transceiver is a wireless, bidirectional, transceiver suitable for short range, omnidirectional communication that allows ad hoc networking of multiple transceivers for purposes of extending the effective range of communication. Ad hoc networking refers to the ability of one transceiver to automatically detect and establish a digital communication link with another transceiver. The resulting network, known as a piconet, enables each transceiver to exchange digital data with the other transceiver. According to one embodiment, BLUETOOTH® involves a wireless transceiver transmitting a digital signal and periodically monitoring a radio frequency for an incoming digital message encoded in a network protocol. The transceiver communicates digital data in the network protocol upon receiving an incoming digital message. Referring again to the figure, the wireless transceiver enables remote communication with the sensor or actuator of module 200.

In general, the effective communication range of BLUETOOTH® is relatively short, often characterized with a maximum range of approximately 10 meters. The short range capabilities of BLUETOOTH® are suitable for premises-based applications, such as data exchange within a range roughly equal to the lineal boundaries of a typical property, or premises. However, communication can be extended beyond this range by a number of different methods.

Figure 3A depicts a method for extending the range of a BLUETOOTH® device involving a long distance communication module, LD comm module 250.

In the figure, module 200 transmits a BLUETOOTH® signal, depicted as link 205, to LD comm module 250. In one embodiment, PDU 400 communicates with a wireless link 225 to LD comm module 250. In one embodiment, link 225 may include a BLUETOOTH® connection, a cellular telephone network, a narrow band personal communication systems ("PCS") network, a CELLEMETRY network, a narrow band trunk radio network or other type of bidirectional wireless communication link. Examples of PCS technology includes Code-Division Multiple Access (CDMA by Qualcomm Inc.), ReFLEX (by Motorola), Time-Division-Multiple-Access (TDMA), Global Systems for Mobile communications (GSM) or others. LD comm module 250 serves a relay function to extend the range of communications for module 200 or to extend the range of communications for PDU 400.

Figure 3B depicts LD comm module 250 coupled by link 210 to radio frequency (RF) tower 300A. RF tower 300A may provide frequency modulation (FM) transmission, satellite transmission capabilities, or other wireless link capabilities. In Figure 3C, LD comm module 250 is coupled by link 210 to network 300B. Network 300B may include wired telephone service, such as plain old telephone service ("POTS") or public switched telephone network ("PSTN"), fibre communication network, or other such network. In Figure 3D, LD comm module 250 is coupled to both RF tower 300A, via link 210A, and network 300B, via link 210B. Other types of networks are also contemplated.

Figure 4 depicts various communication linkages possible using LD comm module 250. Link 225A represents a two-way pager network communicating with PDU 400, depicted herein as a pager device. Link 225B represents a cellular network communicating with PDU 400, depicted herein as a cellular telephone. Link 210C represents a connection to modem 300C. Modem 300C may include a dial-up modem, an asynchronous digital subscriber line ("ADSL") modem, an integrated services digital network ("ISDN") modem or other type of modem. Link 210D represents a telephone communication network and includes telephone 300D. Link 210E represents a network connection depicted as network 300E. It will be appreciated that in Figure 4,

numerous communications linkages are depicted and in any one embodiment, one or more of the various communication linkages depicted may be utilized.

Alternative means of communicating over long distance are also contemplated. In one embodiment, the long distance network may include a cellular telephone network. A user with a cellular telephone, or other cellular device, is then able to communicate with the BLUETOOTH® device as though the user was local. The long distance network may include communications using a control channel. One such example is CELLEMETRY®. CELLEMETRY® is a registered trademark of Cellemetry LLC of Atlanta, Georgia, USA, and enables digital communications over a cellular telephone control channel. Other examples of communication technology are also contemplated, including MicroBurst™ technology (MicroBurst™ is a trademark of Aeris.net, Inc.) or short message service (SMS). In one embodiment, the long distance network may include a pager network. In one embodiment, the pager network is a two-way pager network enabling bidirectional communication between a BLUETOOTH®-enabled sensor, or device, and a user controlled pager. In one embodiment, the long distance network includes a narrow band Personal Communication System network. In one embodiment, the long distance network may include a telephone network. The telephone network may include communicating using an intranet or the Internet. Coupling to such a network may be accomplished, for example, using a variety of connections, including a leased line connection, such as a T-1, an ISDN, a DSL line, or other high speed broadband connection, or it may entail a dial-up connection using a modem. In one embodiment, the long distance network may include a radio frequency or satellite communication network. In addition, one or more of the aforementioned networks may be combined to achieve desired results.

The present system also contemplates various method of control. One example of control is known as dual-tone multi-frequency (DTMF) or touch-tone control. Another example is voice-actuated control wherein the system is responsive to spoken words. Other examples, or combinations, are also contemplated. For example, a system may transmit in one direction using SMS and yet receive communications in another direction using Microburst.

The BLUETOOTH® standard facilitates connectivity, and thus, range extension by coupling a plurality of BLUETOOTH®-enabled devices together. Figure 5 depicts the interconnectivity of several BLUETOOTH®-enabled devices. In this method, a wireless network is established that enables one BLUETOOTH® device to communicate with a second BLUETOOTH® device, effectively extending the range of the first device. The second device serves as a repeater, or relay, and receives and retransmits the BLUETOOTH® signal. By this method, a plurality of BLUETOOTH® devices can be daisy-chained together to achieve a desired range. For example, a single BLUETOOTH® transceiver is often described as having a short range, typically 10 meters (and up to 100 meters), and by combining a plurality of transceivers in a network, the range can be extended. Figure 5 portrays a system having modules 200A, 200B and 200C and LD comm module 250 and PDU 400. In the embodiment shown, modules 200A, 200B and 200C and LD comm module 250 are BLUETOOTH®-enabled, and thus links 202A, 202B and 202C as well as 205 are BLUETOOTH®-communication links. In one embodiment, PDU 400 is also BLUETOOTH®-enabled and thus, link 225 is a BLUETOOTH® communication link as well. In one embodiment, PDU 400 and LD comm module 250 communicate using a long range bidirectional wireless communication network.

An example of the operation of system 100 follows in which module 200A includes a motion detector sensor coupled to a transceiver. Motion detected by the sensor of module 200A is digitally encoded and transmitted by a BLUETOOTH® communication channel. In the embodiment shown, module 200C is positioned within the broadcast range of module 200A, and LD comm module 250 is positioned beyond the range of module 200A. In this case, module 200C receives the signal from module 200A and subsequently relays the digital signal to LD comm module 250. LD comm module 250, in turn, relays the digital signal, using long distance network represented herein by link 225, to PDU 400. The foregoing example describes an embodiment wherein, for example, module 200A is a first motion detector positioned at a front entry door of a residence, module 200B includes a second motion detector positioned at a

rear entry door, module 200C includes a smoke detector positioned in a central hallway, LD comm module 250 is coupled to a twisted-pair telephone network and positioned in the basement, and PDU 400 is a two-way pager device carried by a user at a remote location. In this example, the user can add modules and LD comm modules without regard for the connectivity or overall system design. The self-awareness feature and networking attributes of the BLUETOOTH® technology enable simplified system development and automatically provide range extension for communication linkages.

PDU 400 is a portable communication device operable for communicating digital data and having means for receiving data on a wireless link, displaying or signaling received or generated data, as well as receiving a user controlled input and transmitting data corresponding to the user controlled input. In one embodiment, PDU 400A is a two-way pager (Figure 6A). In one embodiment, PDA 400B is a cellular telephone (Figure 6B). In one embodiment, PDA 400C is a personal data (or digital) assistant (Figure 6C) and is commonly referred to as a PDA. Suitable PDAs include those marketed as PalmVII by Palm Computing of Santa Clara, California, USA. In one embodiment, PDA 400D is a personal communication device (Figure 6D). PDU 400 may also be a portable computer, such as a laptop or palmtop computer (not shown). Upon reading and understanding this description, one of ordinary skill in the art will recognize that PDU 400 includes a processor suitable for managing the transmission and communication functions of the present system.

It will be appreciated by one of ordinary skill in the art that, in one embodiment, one or more PDU 400 devices may be employed in a single installation. Furthermore, suitable encoding of the communication signal will enable custom notification wherein a first group of one or more PDU 400 devices receives and communicates notification for predetermined events sensed by module 200 while a second group of one or more PDU 400 devices does not communicate notification to a user.

One embodiment of present system 100 is shown in Figure 7 which depicts entry door 260 of a residence. Entry door 260, is equipped with lock 275, handle 280 and module 200D mounted on the exterior of the residence and

proximate to entry door 260. Also shown in Figure 9 is entry light 265 for illuminating the entry area, including entry mat 285. In one embodiment, module 200 is in wireless communication with other devices, or PDU 400B, shown in the figure as cellular telephone, via link 220A, and PDU 400A, shown in the figure as a two-way pager, via link 220B. Exterior module 200D is also in wireless communication with base 250A. As depicted herein, base 250 includes LD comm module as well as user operable controls and display to enable programming and operation of system 100. In one embodiment, the wireless communication between module 200D and base 250A includes BLUETOOTH® communication technology. As previously described, module 200D, in one embodiment, is in wireless communication with PDU 400B, via link 220B, base 250A, via link 205, or PDU 400A, via link 220A.

In operation, a caller at entry door 260 can initiate communication with a user via a PDU. For example, in one embodiment, a caller arriving at locked door 260 can operate module 200D in much the same way as a doorbell, that is, by activating a prominent and conspicuous button. Module 200D then encodes and communicates a digital message for transmission to PDU 400. The digital message

may be communicated directly from module 200 to PDU 400B, for example, either directly (via link 220B), or indirectly, via LD comm module 250A. In one embodiment, the communication to, and from, module 200D involves a BLUETOOTH® channel. In this example, the user receives notification of the presence of the caller by means of PDU 400B. The user, and PDU 400B, may be located inside the residence, in which case a direct connection using link 220B may be possible. Alternatively, the user, and PDU 400B, may be located outside of the residence, in which case, an indirect link, including link 205 coupling the LD comm module 250A may be employed. In either case, the caller is unlikely to perceive the actual location of the user. Furthermore, by way of operating the controls or a numeric keypad on PDU 400B, the user may control the operation of entry light 265 or lock 275 and thereby grant access to the premises for the caller.

Figure 8 depicts a top view of one embodiment of the present system as installed at an entry door 260 of a residence. Door 260 is positioned in door frame 258 and includes exterior door knob 282 and interior door knob 284. The installation also includes exterior module 200D and interior module 200E. Exterior module 200D includes video camera 370, exterior keypad 305 and an intercom. Other sensors or detector modules are also contemplated as part of exterior module 200D, such as, for example, a doorbell. Interior module 200E includes interior motion detector/video camera 310, light switch 315 and keypad/control 320. Door 260 is also fitted with deadbolt lock 275 (or door bolt) and door contact 290. Floor mat 285 is shown for purposes of clarity.

In one embodiment, a caller standing in the vicinity of entry mat 285 signals their arrival by actuating a doorbell button, incorporated in exterior module 200D, in the customary manner. In one embodiment, arrival of the caller is detected by video camera 370. In response to actuation of the button, or detection by camera 370, exterior module 200D transmits a wireless signal. In one embodiment, the wireless signal is transmitted using a BLUETOOTH® communication channel. The signal is communicated to PDU 400 (not shown in this figure). A user, equipped with PDU 400 can respond in a number of ways. In one embodiment, the user may elect to open an audio communication channel by entering a command using PDU 400. Upon opening an audio communication channel, the caller and user can engage in bidirectional verbal discourse. In one embodiment, the user may opt to receive a graphical image of the caller using PDU 400. Entry of an appropriate command causes exterior module 200D to capture an image using exterior video camera 370 and transmit said image to PDU 400. The graphical image may include a still image or real-time video images. In one embodiment, a user at a remote locations can enter a command at PDU 400 to cause deadbolt 275 to engage or disengage. In one embodiment, one or more of the aforementioned operations are available using PDU 400.

In one embodiment, the aforementioned communications with exterior module 200D can be performed using interior module 200E in lieu of PDU 400. Both exterior module 200D and interior module 200E communicate using a BLUETOOTH® communication channel and thus are able to engage in direct

communication when mounted sufficiently close to each other. Also, like PDU 400, interior module 200E can control the operation of the exterior module 200D, as well as the deadbolt lock 275 and camera 370.

One embodiment of exterior module 200D of the present system, having doorbell button 325 and keypad 305 is depicted in Figure 9. Exterior module 200D includes alpha-numeric keypad 305 for receiving coded information. For example, in one embodiment, an authorized callers can enter a predetermined code sequence to cause deadbolt lock 275 (Figure 8) to engage or disengage. Also, a user can enter a code sequence in PDU 400, for wireless transmission to exterior module 200D, and operate deadbolt lock 275. In one embodiment, module 200D includes a card reader for receipt of identification information from a caller. The card reader may include a smart-card reader or a magnetic card reader.

Wireless transmissions with exterior module 200D are communicated using transceiver 150D. In one embodiment, a code sequence entered using alphanumeric keypad 305 or PDU 400 can operate entry light 265 (Figure 7) or other devices or appliances. Exterior module 200D also includes video camera 370. In one embodiment, images captured using camera 370 can be transmitted to other devices, including PDU 400 or interior module 200E (Figure 8) or base 250A (Figure 7). In one embodiment, exterior module 200D includes intercom 330 for conducting intercom, or audio communication functions. In one embodiment, intercom 330 includes an audio transducer. In one embodiment, intercom 330 includes a speaker and a microphone.

In one embodiment, exterior module 200D is of a size and configuration to fit within scheduled electric boxes or fixtures. In one embodiment, the power to operate exterior module 200D is derived from the metered electric service already available at the electric box in which module 200D is mounted. In one embodiment, module 200D is battery operated.

Figure 10 depicts one embodiment of interior module 200E having intercom 335, push-to-talk ("PTT") switch 320, interior motion detector/video camera 310, transceiver 150E and light switch 315. Intercom 335, in conjunction with PTT switch 320, enables bidirectional wireless communication.

Intercom 335 can be adapted to communicate with exterior module 200D, PDU 400, base 250A (Figure 7) or other compatible device. Similarly, detected motion or video images captured by camera 310 can be communicated with PDU 400, base 250A, or other compatible device. In one embodiment, interior module 200E is of a size and configuration to fit within scheduled electric boxes or fixtures. In one embodiment, power for interior module 200E is derived from the metered electric service already available at the electric box in which module 200E is mounted. In one embodiment, power is supplied by a battery. In one embodiment, switch 315 operates a household light, power outlet or other appliance.

In one embodiment, the present system can arm or disarm a security system as a function of an image captured by video camera 370 (Figure 8), data received from deadbolt lock 275, or door contact 290. For example, in one embodiment, when door 260 is closed, as determined by contact 290, or the deadbolt 275 is engaged, and the image captured by camera 370 corresponds to an authorized user or caller, then transceiver 150D (Figure 9) sends a signal, on a wireless link, to other modular security system components (such as base 250A, Figure 7), causing perimeter security system components to be armed and interior security system components to be disarmed. Alternatively, when the sensors associated with module 200D, or 200E, indicate the absence of an authorized caller or user, then in one embodiment, both the interior and exterior security system sensors are activated. In one embodiment, deadbolt 275 includes a plunger-type switch to sense the bolt position. Modular security system components are described in a subsequent section of this document.

Figure 11 depicts one embodiment of the present system. In the embodiment shown, the system includes alarm clock and display 340. Devices other than an alarm clock are also contemplated, as, for example, a cordless telephone with display. The alarm clock of Figure 11 is typically positioned in a sleeping room and, thus, is convenient for managing and controlling home devices and appliances, as well as providing easy communication with other modules. Module 200F includes display 340 and user operable control buttons 342, 344 and 346. Module 200F is operable as an ordinary alarm clock having a

digital display of the time appearing on display 340. Control buttons 342, 344 and 346 are operable for setting the current time as well as an alarm time. Module 200F is powered by metered service, internal battery, or both. Module 200F includes a wireless transceiver for control of, or communication with, other wireless modules. In one embodiment, the wireless transceiver operates using BLUETOOTH® communication technology. In Figure 11, module 200F is shown in communication with coffee maker 200G via wireless link 202G, television 200H via wireless link 202H, and furnace 200K, via wireless link 202K and air conditioner 200J via wireless link 202J. In one embodiment, coffee maker 200G, television 200H, furnace 200K and air conditioner 200J are equipped with wireless communication modules. In one embodiment, coffee maker 200G, television 200H, furnace 200K and air conditioner 200J are coupled to a suitably equipped outlet, as described subsequently with regard to Figure 18 or other interface module incorporating the present system.

Module 200F includes suitable programming for the control of such modules. In one embodiment, a user can operate control buttons 342, 344 and 346 to cause module 200F to display, using display 340, a menu of control options concerning each of the various modules. In one embodiment, operation of button 342 enables selection of a desired output device for control by module 200F. For example, the user can select to control coffee maker 200G and furnace 200K by manipulation of control 342. In one embodiment, a coffee maker menu appears in display 340. Again, using buttons, 342, 344 and 346 a user can program the system to cause the coffee maker to perform desired functions according to a programmed schedule. In one embodiment, second button 344 enables a user to select a time for control or operation of the desired output. For example, a user can select to operate a selected output device according to an absolute time. In other words, a user can choose to brew coffee using coffee maker 200G every day at 9:00 AM or other desired time. Button 344 also allows a user to select a relative time for operating a selected output device. For example, a user can configure module 200F to cause the furnace to seek a temperature of 68 degrees Fahrenheit every day at 30 minutes prior to the wake-up alarm setting. As another example, a user can configure the system to

begin brewing coffee thirty minutes prior to sounding the wake-up alarm, and also shut off the power to the coffee warming element 120 minutes after sounding the wake-up alarm. Button 344 also enables a user to select a default, or pre-programmed time for operating a selected appliance. For example, the manufacturer may have configured module 200F to operate a selected output device daily at 8:30 AM unless otherwise provided. Button 346 is operable for setting the clock and for setting an alarm function.

In one embodiment, a user can arm or disarm selected elements of a security system using module 200F. In one embodiment, the user can interact with a caller at an entry door, via exterior module 200D. Upon reading and understanding this description, one of skill in the art will recognize that functions available using PDU 400 are also available using module 200F.

Figure 12 depicts a base station with LD comm module 250A in one embodiment of the present system. In one embodiment, base 250A is in communication with communication network 300 via wireless link 210. Communication network 300 may include, but is not limited to, a cellular telephone network, a CELLEMETRY® network, a two-way pager network, a public switched telephone network or a radio frequency network. Communication network 300 enables long range communication.

Figure 13 depicts one embodiment of the present system. In one embodiment, module 200L is responsive to heat. In one embodiment, module 200L is responsive to smoke. In one embodiment, module 200L is battery powered, and in one embodiment, module 200L is powered by metered electric service. Module 200L is coupled via a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 14 depicts one embodiment of the present system. In one embodiment, modules 200M are responsive to glass breakage of glass panes in window 500. In one embodiment, modules 200M are battery powered, and in one embodiment, modules 200M are powered by metered electric service. Wireless links couple modules 200M to other wireless devices or modules

within the system. In one embodiment, the wireless links comprise BLUETOOTH® communication technology.

Figure 15 depicts one embodiment of the present system. In one embodiment, module 200N includes a video camera mounted to a wall. In one embodiment, module 200N captures and transmits video images and may be battery powered or powered by metered electric service. Module 200N is coupled via wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 16 depicts one embodiment of the present system installed at entry door 510. In one embodiment, module 200Q includes a magnetic contact to detect the position of door 510 relative to door frame 505. Module 200Q is battery powered or powered by metered electric service. Module 200Q is coupled by wireless link to other wireless devices or modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology. Figure 16 also depicts module 200R including deadbolt lock with bolt receiver. In one embodiment, module 200R comprises a sensor to detect the position of the deadbolt lock. Signals generated by module 200R are communicated via wireless link to other wireless devices or modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 17 depicts one embodiment of the present system. In Figure 17, module 200S includes a motion sensor mounted on a wall surface and detects motion of people and animals within the room. In one embodiment, module 200S may be battery powered or powered by metered electric service. In one embodiment, module 200S may include a passive infrared motion sensor. Module 200S is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 18 depicts one embodiment of the present system. In Figure 18, wall mounted duplex outlet 520 is coupled via wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises

BLUETOOTH® communication technology. In response to other wireless modules within the system, including PDU 400, module 200S alternatively powers or unpowers appliances and devices that are connected to outlet 520. In one embodiment, power for the operation of module 200S is derived from the line current supplying outlet 520.

Figure 19 depicts one embodiment of the present system. In Figure 19, module 200U includes a siren, or other sounding device, for sounding an alarm. In one embodiment, module 200U may be battery powered or powered by metered electric service. Module 200U is coupled by wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 20 depicts one embodiment of the present system. In Figure 20, module 200V includes a doorbell for signaling callers. In one embodiment, module 200V is battery powered or powered by metered electric service. Module 200V communicates by wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 21 depicts one embodiment of the present system. In Figure 21, module 200X includes a monitor for receiving and transmitting audio. In one embodiment, module 200X includes audio transducer 530 and control button 535. Activation of control button 535, in one embodiment, operates to send an emergency assistance request to PDU 400 or other module. Module 200X is operable as a room or baby monitor. In one embodiment, module 200X is operable as part of a bidirectional intercom system. In one embodiment, module 200X may be battery powered or powered by metered electric service. Module 200X is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 22 depicts one embodiment of the present system. In Figure 22, module 200Y includes a monitor for receiving and transmitting audio and transmitting video sensed by optical sensor 540. In one embodiment, module 200Y includes audio transducer 530, control button 535, and optical sensor 540.

Module 200Y is operable as a room or baby monitor. In one embodiment, module 200Y is operable as a part of a bidirectional audiovisual intercom system. In one embodiment, module 200Y may be battery powered or powered by metered electric service. Module 200Y is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 23 depicts one embodiment of the present system. In Figure 23, module 200Z includes a building environmental control device. In one embodiment, module 200Z includes a thermostat. In one embodiment, module 200Z includes a humidistat. In one embodiment, module 200Z includes programming to allow a user to enter, or select, a schedule for operating and controlling heating, ventilation or air conditioning ("H/VAC") equipment. Module 200Z includes visual display 545 and user operable control 550. In one embodiment, module 200Z may be battery powered, powered by metered electric service, or powered by a system voltage used to operate the heating, ventilating, or air conditioning equipment. In one embodiment, the system voltage is a low voltage 24 VAC service. Module 200Z is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology. In operation, one embodiment enables a user to control the operation of heating, ventilating, or air conditioning equipment from PDU 400. In addition, one embodiment provides that measured or sensed data is transmitted to PDU 400 for the benefit of a user. In addition, one embodiment having control 550, enables a user to program and determine the operation the H/VAC equipment. Other functions are also contemplated, including programming of the H/VAC system operation, monitoring the H/VAC system integrity or troubleshooting operation of various system components.

Figure 24 depicts one embodiment of the present system. In Figure 24, module 200AA is an atmospheric condition monitoring device. In one embodiment, module 200AA is a thermometer. In one embodiment, module 200AA is a barometric pressure monitor. In one embodiment, module 200AA includes a first display 555 and a second display 560 for monitoring outdoor and

indoor air temperature, respectively. Data generated by module 200AA may also be communicated to other devices, including, for example, PDU 400 for display to the user or to environmental or H/VAC system control equipment such as that depicted in Figure 23. In one embodiment, module 200AA may be battery powered, system (or appliance) power or powered by metered electric service. Module 200AA is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 25 depicts one embodiment of the present system. In Figure 25, module 200AB is another embodiment of an atmospheric condition monitoring device. In one embodiment, module 200AB includes a temperature probe or other remote sensor. In one embodiment, module 200AB operates in conjunction with, and communicates with the module of Figure 24 or Figure 23. Data generated by module 200AB may also be communicated to other devices, including, for example, PDU 400 for display to the user or to environmental or H/VAC system control equipment. In one embodiment, module 200AB may be battery powered, solar powered or powered by metered electric service. Module 200AB is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 26 depicts an organizational diagram for one embodiment of a module system as herein described. Modular system 100 includes a security system 565 and an environmental controls and monitoring system 570. Security system 565 may also provide safety features.

In the embodiment shown, security system 565 includes detection system 575 and notification system 580. Other systems are also contemplated, including for example, configuration, programming and diagnostic or troubleshooting systems. Detection system 575 include components such as a motion detector (including a passive Infrared "PIR" sensor), a door or window contact or a video camera. Notification system 580 includes components such as a wireless communication link, a PDU 400 device, a visual display, or an alarm clock-based control such as that depicted in Figure 11. Safety system components may

include an emergency call button module or a portable personal locator module driven by a global positioning satellite system (GPS) or other situational sensor.

In the embodiment shown, environmental controls and monitoring system 570 includes sensors and detectors 585, reporting 590 and actuators and transducers 595. Other systems are also contemplated, including for example, configuration, programming and diagnostic or troubleshooting systems. Sensors and detectors 585 include components such as a temperature probe, a position sensor (for determining an actuator position) or a fluid or gas detector. Reporting 590 includes components such as a wireless communication link, a PDU 400 device, a visual display, or an alarm clock-based control such as that depicted in Figure 11. Actuators and transducers 595 may include components such as a thermostat control, a sounding device such as a siren and others.

Figure 27 depicts one embodiment of the present system configured for building security and environmental control. In Figure 27, PDU 400 is wirelessly coupled to a plurality of sensor or control modules. PDU 400 is operable to wirelessly manage the system from a short range as well as a long range. In Figure 27, the system comprises perimeter modules 620A, 620B and 620C. In one embodiment, modules 620A, 620B and 620C may include a door contact, a video camera, a glass breakage detector, or other types of modules configured to detect a security breach occurring at the perimeter of a building or premises. Figure 27 also depicts a plurality of interior sensor modules, designated 625A, 625B and 625C. In one embodiment, modules 625A, 625B and 625C may include a motion detector, a video camera, a proximity detector, an intercom or monitor or other types of sensors configured to detect a security breach occurring in the interior of a building or premises. Figure 27 also depicts a plurality of building control or sensor modules, designated 630A and 630B. In one embodiment, modules 630A and 630B may include a thermostat, a humidistat, an electric window blind, an air conditioner control, a door lock control or other types of controls or sensors configured to manage a building or premises. Figure 27 also depicts a plurality of power control modules, designated 635A and 635B. In one embodiment, modules 635A and 635B may include power outlets coupled to such devices as a coffee maker, a television or

VCR, a floor lamp or other types of appliances or devices. Figure 27 also depicts a plurality of reporting sensor modules, designated 640A, 640B and 640C. In one embodiment, modules 640A, 640B and 640C may include a smoke detector, a freeze detector, a carbon monoxide detector, an interior/exterior temperature detector, or other types of sensors configured to facilitate management of a building or premises. In one embodiment, a reporting sensor module may include a device configured to monitor salt levels in a water softener. Such a sensor can communicate wirelessly with PDU 400 to report the need for servicing of a water softener. In one embodiment, a reporting sensor may include a device configured to monitor the status or operation of an air filter in a heating or ventilation system. Such a sensor can communicate wirelessly with PDU 400 to report the need for servicing of the filter. In one embodiment, a reporting sensor may include a module configured to monitor the condition of a rain gutter or eave trough. Such a module can communicate wirelessly with PDU 400 to report the need for servicing of a rain gutter or eave trough. Other such modules are also contemplated by the present description.

Figure 28 depicts another embodiment of the present system. Figure 28 depicts a computer 700 coupled to keyboard or input device 705, and display monitor 710. Computer 700 includes a processor, memory and preferably includes one or more disk drives. Computer 700 also includes a module having a wireless transceiver for communication with other modules or PDU 400 devices. In one embodiment, the wireless communication of data is conducted using BLUETOOTH® communication technology. Programming operable on computer 700 enables management of the sensors, devices, controls or modules of the present system. In one embodiment, menu-driven programming enables a user to configure the system to report predetermined conditions to a local or remote PDU 400 or a remote monitoring facility. In one embodiment, the system reports to an e-mail address. In one embodiment, the system reports to an Internet address. In one embodiment, suitable programming enables a user to configure the system to periodically report predetermined conditions needing servicing. For example, periodic cleaning of a gutter or eave trough can be

enunciated to a portable PDU 400 configured to wirelessly communicate with the present system.

Figure 29 depicts control program 720 and representative modules controllable using one embodiment of the present system. For example, module 725 may include an alarm clock module which can be wirelessly managed and controlled using program 720 operating on computer 700. As another example module 730 may include a furnace filter sensor that can be wirelessly monitored using program 720 operating on computer 700. Other modules are also depicted, enumerated 735, 740, 745 and 750, each of which may include any type of module herein disclosed, including, for example, sensors for managing the operation of a water softener, monitoring and managing exterior building maintenance, operating and maintaining a coffee maker, operating a television or entertainment center or operating a furnace. In one embodiment, the wireless communication of data is conducted using BLUETOOTH® communication technology.

In the embodiment of Figure 29, LD comm module 755 is shown coupled to control program 720. In operation, LD comm module can be configured by program 720 to communicate with a predetermined network selected from a plurality of networks. As another example, LD comm module con be configured to communicate with a predetermined PDU 400 using a preselected schedule for communicating. In other words, one example provides that for weekdays, LD comm module 755 communicates using a two-way pager network and directs all communications to a PDU 400 carried by a first person, and on weekends, LD comm module 755 is configured to communicate with a second person using a PDU 400 over a cellular telephone network. Other configurations and combinations are also contemplated. As another example, control program 720 may be configured to report H/VAC equipment status to a first PDU 400 and security system signals to a second PDU 400.

Figure 31 illustrates a block diagram of one embodiment of present system 10000. System 10000, illustrated by the dashed box, includes processor 12000, power supply 12500, transceiver 13000, programming 15000 and position sensor 15500. Processor 12000 is coupled to, and executes,

programming 15000. Processor 12000 is also coupled to elements labeled power 12500 and transceiver 13000.

In the figure, GDO 1000 represents a garage door opener which may include system 1000 as previously described relative to Figure 32. It will be appreciated that, for purposes of this description, the garage door opener 1000 is not included in the system. However, other embodiments of the system are also contemplated, one of which includes the garage door opener as part of the system.

Processor 12000 may include a microprocessor as well as memory to perform the programmed functions and to retain settings and configuration information. Processor 12000 may also include a driver circuit to provide an electrical signal at a level sufficient to operate the garage door opener. Processor 12000 may also include a circuit to receive electrical signals from electrical, or electromechanical sensors and monitors and to provide an electrical signal to drive an actuator.

Power supply 12500 represents a power supply system that provides electrical energy for system 10000. As described in a subsequent section, power supply 12500 may include a battery power supply and a line powered supply.

Programming 15000 may include the instructions and data to enable the processor to perform the functions of the present system. Among the programming functions in one embodiment are instructions for causing processor 12000 to actuate a particular control upon receiving a predetermined signal. For example, if a garage door position sensor indicates that the door is in a raised position and an obstruction in the path of the garage door travel is detected by an optical sensor, then a signal received by the processor requesting the door to be closed is met with programming requesting that the obstruction be cleared before the door will travel. Processor 12000 and programming 15000 may include logic gates, circuitry or software to accomplish the selected functions.

Transceiver 13000 represents a wireless receiver and transmitter able to communicate using both a long range communication protocol and a short range communication protocol. For example, in one embodiment, the transceiver

module includes two separate transceivers, namely, a long range transceiver 13500 for long range communications, such as that used with cellular telephone communications and second transceiver for communicating over a short range. A short range communication protocol, such as BLUETOOTH®, allows wireless communications over distances commonly thought of as premises-based. It will be further appreciated that with suitable repeaters, gateways, switches or networks, the effective range of communication of transceiver 13000 may be extended to any distance.

In one embodiment, transceiver 13000 communicates, using a short range protocol, with a second transceiver that communicates using a long range protocol. For example, transceiver 13000 may include a BLUETOOTH® transceiver and may communicate with a second transceiver. The second transceiver, in addition to having a BLUETOOTH® section, also interfaces with a long range communication network. For example, the second transceiver may include a BLUETOOTH® transceiver and a connector that interfaces with a public switched telephone network (PSTN), a cellular telephone network, a pager network or other network having a long range communication protocol.

According to one definition, and subject to the vagaries of radio design and environmental factors, short range may refer to systems designed primarily for use in and around a premises and thus, the range generally is below a mile. Short range communications may also be construed as point-to-point communications, examples of which include those compatible with protocols such as BLUETOOTH®, HomeRF™, and the IEEE 802.11 WAN standard (described subsequently). Long range, thus, may be construed as networked communications with a range in excess of short range communications. Examples of long range communication may include, Aeris MicroBurst cellular communication system, and various networked pager, cellular telephone or, in some cases, radio frequency communication systems.

In various embodiments, a user may communicate with system 10000 using a telephone coupled to the public switched telephone network (PSTN), a cellular telephone, a pager (either one way or two way), a personal

communication device (such as a personal digital assistant, PDA), a computer, or other wired or wireless communication device.

Position sensor 15500 is coupled to processor 12000. In various embodiments, sensor 15500 may include one or more magnetic switches, contact switches, optical devices or cameras. For example, in one embodiment, sensor 15500 includes a first magnetic switch to detect door 4000 in an open position and second magnetic switch to detect door 4000 in a closed position. Sensor 15500 may be connected to processor 12000 by a wired connector or by a wireless link. Sensor 15500 provides an electrical signal corresponding to the position of door 4000. The input to sensor 15500 may be derived from door 4000, trolley 2500, or other member that provides reliable information relative to the position of door 4000.

An embodiment of transceiver 13000 is illustrated in Figure 32. Transceiver 13000A is coupled to processor 13000 by link 132A. In the figure, transceiver 13000A is shown having compatibility with both a cellular telephone protocol 13500A and a BLUETOOTH® protocol 14000A. Other long range communication protocols may include, but are not limited to, cellular telephone protocols, one way or two-way pager protocols, and personal communication service (PCS) protocols. Examples include Time Division Multiple Access (TDMA), 3G, Aloha, Global System for Mobile Communications (GSM), Code-Division Multiple Access (CDMA), Short Message Service (SMS) and General Packet Radio Service (GPRS).

Personal Communications Service (PCS) describes a set of cellular technologies employing CDMA (also known as IS-95), GSM, or North American TDMA (also known as IS-136) air interfaces. PCS systems typically operate in the 1900 MHZ frequency range.

Time Division Multiple Access (TDMA) describes a digital wireless technology using time-division multiplexing (TDM) in which a radio frequency is time divided and slots are allocated to multiple calls. TDMA is used by the GSM digital cellular system.

A third specification, known as 3G, promulgated by the ITU (International Telecommunication Union, headquarters in Geneva, Switzerland)

represents a third generation of mobile communications technology with analog and digital PCS representing first and second generations. 3G is operative over wireless air interfaces such as GSM, TDMA, and CDMA. The new EDGE (Enhanced Data rates for Global Evolution) air interface has been developed specifically to meet the bandwidth needs of 3G.

Another protocol, known as Aloha, enables satellite and terrestrial radio transmissions.

Global System for Mobile Communications, GSM, is another digital cellular system and uses TDMA, thus allowing eight simultaneous calls on the same radio frequency.

Code-Division Multiple Access (CDMA) is a digital cellular technology that uses spread-spectrum techniques. CDMA does not assign a specific frequency to each user but rather every channel uses the full available spectrum and individual conversations are encoded with a pseudo-random digital sequence.

Another transmission protocol, Short Message Service (SMS) allows communications of short messages with a cellular telephone, fax machine and an IP address. Messages are generally limited to a length of 160 alpha-numeric characters.

General Packet Radio Service (GPRS) is another standard used for wireless communications and operates at transmission speeds far greater than GSM. GPRS can be used for communicating either small bursts of data, such as e-mail and Web browsing, or large volumes of data.

The short range communication protocol may include, but is not limited to, wireless protocols such as BLUETOOTH®, HomeRF™, wireless LAN (WLAN) or other personal wireless networking technology.

BLUETOOTH® is a trademark registered by Telefonaktiebolaget LM Ericsson of Stockholm, Sweden and refers to short range communication technology developed by an industry consortium known as the BLUETOOTH® Special Interest Group. BLUETOOTH® operates at a frequency of approximately 2.45 GHZ, utilizes a frequency hopping (on a plurality of frequencies) spread spectrum scheme, and provides a digital data transfer rate of

approximately 1Mb/second. In one embodiment, the present system includes a transceiver in compliance with BLUETOOTH® technical specification version 1.0, herein incorporated by reference. In one embodiment, the present system includes a transceiver in compliance with standards established, or anticipated to be established, by the Institute of Electrical and Electronics Engineers, Inc., (IEEE). The IEEE 802.15 WPAN standard is anticipated to include the technology developed by the BLUETOOTH® Special Interest Group. WPAN refers to Wireless Personal Area Networks. The IEEE 802.15 WPAN standard is expected to define a standard for wireless communications within a personal operating space (POS) which encircles a person. In one embodiment, the transceiver is a wireless, bidirectional, transceiver suitable for short range, omnidirectional communication that allows ad hoc networking of multiple transceivers for purposes of extending the effective range of communication. Ad hoc networking refers to the ability of one transceiver to automatically detect and establish a digital communication link with another transceiver. The resulting network, known as a piconet, enables each transceiver to exchange digital data with the other transceiver. According to one embodiment, BLUETOOTH® involves a wireless transceiver transmitting a digital signal and periodically monitoring a radio frequency for an incoming digital message encoded in a network protocol. The transceiver communicates digital data in the network protocol upon receiving an incoming digital message.

In general, the effective communication range of BLUETOOTH® is relatively short, sometimes characterized with a maximum range of approximately 10 to 100 meters. The short range capabilities of BLUETOOTH® are suitable for premises-based applications, such as data exchange within a range roughly equal to the lineal boundaries of a typical property, or premises.

Communication range can be extended beyond this range by a number of different methods. For example, the range may be extended by coupling a BLUETOOTH® connection with a cellular telephone network, a narrow band personal communication systems ("PCS") network, a CELLEMETRY network, a narrow band trunk radio network or other type of wireless communication link.

Examples of PCS technology includes Code-Division Multiple Access (CDMA by Qualcomm Inc.), ReFLEX (by Motorola), Time Division Multiple Access (TDMA), Global Systems for Mobile communications (GSM) or others.

A user with a cellular telephone, or other cellular device, is then able to communicate with the BLUETOOTH® device as though the user was local. The long distance network may include communications using a control channel. One such example is CELLEMETRY®. CELLEMETRY® is a registered trademark of Cellemetry LLC of Atlanta, Georgia, USA, and enables digital communications over a cellular telephone control channel. Other examples of communication technology are also contemplated, including MicroBurst™ technology (MicroBurst™ is a trademark of Aeris.net, Inc.) or short message service (SMS). In one embodiment, the long distance network may include a pager network. In one embodiment, the pager network is a two-way pager network enabling bidirectional communication between a BLUETOOTH®-enabled sensor, or device, and a user controlled pager. In one embodiment, the long distance network includes a narrow band Personal Communication System network. In one embodiment, the long distance network may include a telephone network. The telephone network may include communicating using an intranet or the Internet. Coupling to such a network may be accomplished, for example, using a variety of connections, including a leased line connection, such as a T-1, an ISDN, a DSL line, or other high speed broadband connection, or it may entail a dial-up connection using a modem. In one embodiment, the long distance network may include a radio frequency or satellite communication network. In addition, one or more of the aforementioned networks may be combined to achieve desired results.

Another short range communication protocol, known as HomeRF™, currently defined by specification 2.1, provides support for broadband wireless digital communications at a frequency of approximately 2.45 GHZ. HomeRF™ specification 2.1 is herein incorporated by reference.

Other long range and short range communication protocols are also contemplated and the foregoing examples are not to be construed as limitations but merely as examples.

Transceiver 13000 may be compatible with more than two communication protocols. For example, transceiver 13000 may be compatible with three protocols, such as a cellular telephone communication protocol, a two-way pager communication protocol, and BLUETOOTH® protocol. In such a case, a particular garage door opener may be operable using a cellular telephone, a two-way pager, or a device compatible with BLUETOOTH®. Furthermore, it will be appreciated that each of the aforementioned devices, namely a cellular telephone, a two-way pager, and a device compatible with BLUETOOTH®, may be combined in a single portable housing.

Transceiver 13000 may include circuitry to allow communications on more than one protocol. For example, position information may be received on a pager protocol and a user may transmit a command to operate the door opener using a cellular telephone protocol.

Figure 33 illustrates an embodiment of transceiver 13000B that is compatible with a pager protocol 13500B and a BLUETOOTH® protocol 14000B. Transceiver 13000B is coupled to processor 13000 by link 132B. Pager protocol 13500B may include one way or two way pager protocols. Examples of one way pager protocols include Post Office Code Standardisation Advisory Group (POCSAG), Swedish Format (MBS), the Radio Data System (RDS, by Swedish Telecommunications Administration) format and the European Radio Message System (ERMES, by European Telecommunications Standards Institute) format, Golay Format (by Motorola), NEC-D3 Format (by NEC America), Mark IV/V/VI Formats (Multitone Electronics), Hexadecimal Sequential Code (HSC), FLEX™ (Motorola) format, Advanced Paging Operations Code (APOC, by Philips Paging) and others. Examples of two way pager protocols include ReFLEX™ (Motorola) format, InFLEXion™ (Motorola) format, NexNet™ (Nexus Telecommunications Ltd. of Israel) format and others.

In one embodiment using a pager system, system 1000 provides a pager signal to indicate the position of the door or any other information relative to the garage or the door opener. Using a one way pager, the user may operate the door opener, or operate an actuator, using another communication channel, including for example, a cellular telephone or a personal communication device. Using a

two way pager, the user may operate the door opener, or operate an actuator, using the reply communication channel of the pager. The outbound signal (e.g., indicating the door position) may be transmitted to the pager on a predetermined schedule, or upon inquiry, or upon a change of position of the door (or actuator) at any time.

Figure 34 illustrates one embodiment of power supply 12500A. Battery power 12700 may include a dry cell, a gel cell, or other power supply. In addition, battery power 12700 may include rechargeable batteries. The recharging power may be supplied by line power 12800, solar power derived from sunlight, or other available means. Line power 12800 may include 110 volt metered electric service, 220 volt metered electric service, or other convenient electrical service. In one embodiment, door opener 1000 includes a plug-in power cord which couples to a nearby electrical outlet. In such a case, the battery power 12700 is received from line power 12800.

In the event of a power outage, or other interruption of the metered electric service, door opener 1000 may not be operable. However, battery power 12700 has sufficient capacity to continue powering processor 12000, transceiver 13000, and position sensor 15500. Battery power 12700 allows the user to continue to wirelessly receive information regarding the position of the door regardless of the status of line power 12800. In one embodiment, transceiver 13000 provides a wireless signal to the user to indicate that line power 12800 has been restored.

Figure 35 illustrates a variety of sensors, actuators, and transducers coupled to processor 12000. Driver circuits and receiver circuits may be employed between the sensors, actuators, and transducers to provide a signal level compatible with that of the processor. In various embodiments, one or more of the following sensors, actuators, and transducers may be included in system 10000. In one embodiment, system 10000 includes apparatus to provide a camera view of the door. The camera view may be derived from a video camera or still camera as part of system 10000 and the view may represent full motion video or still photos of the door or other operated equipment.

Auxiliary sensor 16000 may be coupled to processor 12000. Sensor 16500 represents an example of an auxiliary sensor coupled to a service door or other entry. The service door may provide access to the interior of the garage or it may provide access to other areas associated with the garage. For example, sensor 16500 may monitor the position of a gate at the driveway to the garage. Optical sensor 17000 may include any sensor relying on optical information to generate an electrical signal. For example, sensor 17000 may include a light source and photocell to detect hazards associated with operation of door 4000 or sensor 17000 may provide a signal to indicate if an interior or exterior garage light is illuminated. Sensor 17000 may also provide a signal to indicate if it is daytime or nighttime. Temperature sensor 17500 may include a thermal element to indicate a temperature present inside the garage or external to the garage. For example, sensor 17500 may indicate a freezing hazard or an overheating condition within the garage. Temperature sensor 17500 may also be coupled to door opener 1000 to indicate a dangerous overheating condition of opener 1000.

Door opener 1000 may be coupled to processor 12000. Door opener 1000 may include a system as described above relative to Figure 32.

Auxiliary sensor 18500 may be coupled to processor 12000 and may include electrical or mechanical actuators or controls other than opener 1000. For example, sensor 19000 indicates a courtesy light controller. Using the remote control of the present system, a user can control an interior or exterior courtesy light. Controlling the light may include adjusting the brightness or turning it on, off or flashing the light. As another example, HVAC actuator 20000 represents any or all elements of a heating, ventilation and air conditioning system. In particular, HVAC actuator 20000 may include a coupling to a mechanical actuator, thermostat, ventilation system or other control. Using the remote control of the present system, a user can control heating, ventilation, or air conditioning system. Sensor 17500 may operate in conjunction with HVAC actuator 20000. Service door operator 19500 indicates a power door actuator coupled to a service door, or other entry, providing access to the interior of the garage or other space.

Audio transducer 21000 may be coupled to processor 12000 and may include a microphone, speaker, or other audio transducer. The microphone is mounted in a position to receive local audio from a caller located outside of the garage. In one embodiment, audio transducer 21000 includes a microphone mounted on the external surface of the structure (or garage) having door opener 1000. Alternatively, the transducer is mounted in the interior of the garage and an orifice is provided in the garage wall to pick up sounds external to the garage. Transducer 21000, in conjunction with processor 12000, provides a voice recognition system that enables voice control of operation of door opener 1000, or other actuators.

Figure 36 graphically presents a block diagram of the functions performed by the programming executing on processor 12000. Programming 15000 includes, in various embodiments, web server programming 24000, auxiliary sensors programming 26000, door opener programming 21500, auxiliary actuator programming 28500 and voice recognition programming 31000. Programming may include circuitry, logical gates, software, or other elements.

Web server programming 24000 provides an interface to allow remote control of system 10000. For example, and not by way of limitation, server programming 24000 may include a wireless application protocol (WAP) server that couples to a telephone (or other communication) network to allow a user to operate, program and monitor system 10000. In one embodiment, a WAP server generates data that can be accessed using an Internet browser. In such a case, for example, the user can remotely configure system 10000 to turn off heater (part of HVAC system 20000) anytime door 4000 is open and the exterior temperature (as determined by temperature sensor 17500) is below 50 degrees Fahrenheit. As another example, the user can remotely configure system 10000 to block operation of door opener 1000 in response to voice commands (received by audio transducer 21000) from a selected person. Data for the user-selected programming may be stored in memory coupled to processor 12000. These and other programming configurations are contemplated.

Auxiliary sensors programming 26000 may include position sensor programming 26500, temperature sensor programming 27500, and optical sensor programming 27000. Position sensor programming 26500 may include software routines and modules that receive and interpret position information derived from door position sensor 16500. Optical sensor programming 27000 may include software routines and modules that receive and interpret information from optical sensor 17000. Temperature sensor programming may include software routines and modules that receive and interpret information from temperature sensor 17500. Other sensors, and appropriate programming, are also contemplated.

Door programming may include position sensor programming 22000 and actuator programming 22500. Position sensor programming 22000 may include software routines and modules that receive and interpret position information derived from a door position sensor as part of door opener 1000. Actuator programming may include door open programming 23000 and door close programming 23500. Door open programming 23000 may include software routines and modules that raise door 4000 in response to commands received by processor 12000. Door close programming 23500 may include software routines and modules that lowers door 4000 in response to commands received by processor 12000. Both door open programming 23000 and door close programming 23500 may also include programming that executes instructions in accordance with user specified, or predetermined, configurations. Door close programming 23500 may also check for obstructions in operating the door before instructing door opener 1000 to move to a closed position.

Auxiliary actuator programming may include, for example, courtesy light control programming 29000, HVAC programming 30000 and service door control programming 29500. Courtesy light control programming 29000 may include software routines and modules that control the operation of an interior, or exterior, courtesy light associated with the garage and coupled to processor 12000 by courtesy light controller 19000. HVAC programming 30000 may include software routines and modules that control the operation of HVAC system 20000 coupled to processor 12000. Service door control programming

29500 may include software routines and modules that control the operation of service door operator 19500 coupled to processor 12000.

Programming also may include voice recognition programming 31000. Voice recognition programming 31000 may include software programming for recognizing and executing instructions commensurate with a voice recognition system. The voice recognition system allows a user to speak into audio transducer 21000 and gain control over the operation of system 10000. Programming 31000 may include a security function to authenticate a voice command received by audio transducer 21000 before executing any instructions to operate door opener 1000.

Other programming functions are also contemplated. For example, a predetermined default setting can be configured to control the operation of system 10000 in the absence of a user specified configuration. The user may specify a desired configuration by providing instructions through audio transducer 21000, transceiver 13000, or a remote link using web server programming 24000.

Programming 15000 may also include software routines or modules to address prioritization matters. With multiple devices configured to independently control the operation of a single door opener, a problem may arise if conflicting commands are simultaneously received by the system. For example, a conflict arises if a first user transmits a long range communication to open the garage door and at the same time (or shortly thereafter) a second user transmits a short range communication to close the same door. A conflict may also arise if a first user attempts to operate a door using a wired button while a second user attempts to operate the same door using a transmitter compatible with a short range protocol of the present system 10000. In such cases, programming 15000 executing on processor 12000 will execute a routine to determine priority of each received command and suppress lower priority commands. For example, in one embodiment, the long range protocol may be configured to be inferior to that of short range protocol and, in turn, the short range protocol may be inferior to directly wired switch coupled to opener 1000. Other priority configurations may also be established. For example,

prioritization may be determined on the basis of proximity to opener 1000, on the basis of identity of a transmitter, on the basis of signal strength received by transceiver 13000, on the basis of recency of last communication, or on any other basis. In one embodiment, the user is empowered to establish a desired configuration. A default configuration may also be provided which is operable in the event that a user-defined configuration is not operable.

Programming 15000 may include instructions to cause processor 12000 to transmit position information, or any other information, using all modes of communication. In one embodiment, the user is afforded an opportunity to specify the distribution of position information. For example, the user may specify that position information is to be transmitted using only a long range communication protocol during specified hours and to a particularly specified user or group of users.

Programming 15000 may also enable processor 12000 to communicate with a building security system or control system. For example, in the event of a particular detected security event, door opener 1000 may be instructed to either close or open.

Figure 37 includes a flow chart describing method 35000 involving one embodiment of the present system. Method 35000 describes operation of system 10000 for receiving door position information and for controlling the door from a remote location.

The method starts at item 35500 and assumes that the user has a wireless device capable of communicating with transceiver 13000. At 36000, the user and system 10000 establish a link on a communication channel. At 36500, door position information is received by the user. In one embodiment, sensor 15500 provides the position information to processor 12000. At 37000, the user receives notification of the door position information. The door position may be indicated by a pair of lights on a pager (one light labeled "open" and another "close"), by a graphical image on a screen, a recognizable audio tone, a recognizable vibration, or any other means of indicating position to a user. At 37500, the user is presented with one or more options to control system 10000. In the case that door 4000 is open, options may include partially, or fully, closing

the door. A single option may be presented that allows the user to toggle the position of the door between a closed and an open position. The option may be a button or several buttons. At 38000, the user indicates a selection using the portable wireless device. At 38500, the wireless device encodes a message for transmission to system 10000 including instructions to operate the door according to the user selection. At 39000, the message is transmitted to system 10000. The message may be routed to system 10000 on wired or wireless communication networks. The method ends at 39500.

Other Embodiments

In one embodiment, system 10000 is coupled to multiple door openers 1000. For example, many homes include two or more garages, each having an individual door opener. Also, commercial applications often include multiple overhead doors, each having an individual door opener. In such cases, multiple door openers 1000 may be coupled to a single system 10000 which controls and reports the operation of each door opener.

In one embodiment, programming 15000 allows a user having a cellular telephone in communication with system 10000 to control and monitor each of several door openers 1000, or other systems coupled to processor 12000. In one embodiment, programming 15000 allows a user to control and monitor a single door opener 1000, or other system coupled to processor 12000. Identification and group membership routines implemented by processor 12000 and programming 15000 allow for a superior user to configure the authority of multiple inferior users over multiple door openers 1000, each coupled to processor 12000, using system 10000.

The present system has been described, in part, relative to the operation of a garage door opener. However, it will be noted that other doors may be controlled and operated using a suitable power opener. The actuator for many garage door openers is electrically operated, however, it is understood that an actuator operable with the present system may include a pneumatically or hydraulically operated actuator. Furthermore, it will be appreciated that, in addition to operating a door, the present system and method may be adapted for use with other controls, such as a window control, Venetian blind control,

skylight control, or other operable device or actuator. By way of example, the present system and method may be adapted to operate with a pet access door, a house entry door, an interior swing door, a patio sliding door, a pocket door, an apartment entry door, a sliding window, or an elevator or lift access door. For instance, the present system may be adapted for use with a handicap access door.

In one embodiment, system 10000 includes circuitry and programming to detect proximity of a compatible transceiver. For example, system 10000 may include a BLUETOOTH® compatible transceiver which implements a self-aware feature to determine the presence of a compatible device within effective range. Thus, if system 10000 detects that a compatible device is within range, then a preprogrammed function is executed. Security systems or authorization systems are included in system 10000 to ensure that any detected compatible device is authorized to exercise control over system 10000. For instance, and in one embodiment, if a BLUETOOTH® equipped wireless garage door opener is brought within a predetermined range, then system 10000 automatically operates an electric garage door opener. In particular, if the door is closed at a time when the door opener is brought within range, then system 10000 operates to open the door and if the door is open at a time when the door opener is brought within range, then system 10000 operates to close the door. As another example, one embodiment of the present system 10000 includes a BLUETOOTH® equipped wireless pet collar and a BLUETOOTH® equipped pet door opener. The pet door is thus automatically opened when a dog wearing the collar approaches the door. As yet another example, one embodiment of the present system 10000 includes a BLUETOOTH® equipped module and a BLUETOOTH® equipped handicapped-person accessible door opener. The handicapped-person accessible door is thus automatically opened when a person carrying the module approaches the door. The module may be affixed to a wheelchair or other device.

Conclusion

Other embodiments are possible and the examples provided herein are intended to be demonstrative and not exclusive or exhaustive of the present invention, which is determined by the scope of the appended claims and the full range of equivalents to which they are entitled.

WHAT IS CLAIMED IS:

1. A device comprising:

a security sensor for detecting a condition; and

a wireless transceiver electrically coupled to the sensor, the wireless transceiver for communicating with the security sensor, the wireless transceiver adapted for monitoring a radio frequency for an incoming digital message in a network protocol and adapted for retransmission of digital messages in the network protocol.

2. The device of claim 1 wherein the wireless transceiver operates on a frequency of approximately 2.45GHz.

3. The device of claim 1 or 2 wherein the wireless transceiver is substantially compatible with standards under IEEE 802.15.

4. The device of any of claims 1 to 3 wherein the wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

5. The device of any of claims 1 to 4 wherein the security sensor comprises a motion sensor, a passive infrared (PIR) motion detector, a pressure sensor, a position sensor, a proximity sensor, a glass breakage sensor, or a video camera.

6. The device of any of claims 1 to 5 further comprising an environmental sensor, the environmental sensor coupled to, and in communication with, the wireless transceiver.

7. The device of claim 6 wherein the environmental sensor comprises a temperature sensor, a gas sensor, a particulate sensor, a fluid sensor, or a sound sensor.

8. The device of any of claims 1 to 7 further comprising a control coupled to, and in communication with, the wireless transceiver.

9. The device of claim 8 wherein the control comprises a power control, an appliance control, an air conditioner control, a furnace control, or a ventilation control.

10. The device of any of claims 1 to 9 further comprising an operable security device coupled to the wireless transceiver.

11. The device of claim 10 wherein the operable security device comprises a lock or a siren.

12. The device of any of claims 1 to 11 wherein the wireless transceiver relays communications between a plurality of other wireless transceivers.

13. The device of any of claims 1 to 12 wherein the wireless transceiver communicates with a long range, bidirectional wireless network.

14. The device of any of claims 1 to 13 wherein the wireless transceiver communicates with a telephone, a cellular telephone, a pager, a computer, a personal communication service (PCS) device, a narrowband PCS device, a two-way pager, or a personal data assistant.

15. The device of any of claims 1 to 14 wherein the sensor and the wireless transceiver are powered by battery or metered electric service.

16. A system comprising:

a security device;

a first wireless transceiver electrically coupled to the security device, the first wireless transceiver adapted for communicating with the security device, monitoring a plurality of radio frequencies, retransmitting digital data in a digital

network protocol, receiving outbound data from the security device and wirelessly transmitting the outbound data using the digital network protocol, and adapted for wirelessly receiving incoming digital data in the network protocol and communicating the incoming digital data to the security device; and

a second wireless transceiver in communication with the first wireless transceiver, the second wireless transceiver adapted for monitoring the plurality of radio frequencies, receiving and retransmitting digital data in the digital network protocol, communicating outgoing data to a user, and transmitting the incoming digital data.

17. The system of claim 16 wherein the first wireless transceiver is a spread spectrum transceiver.

18. The system of claim 16 or 17 wherein the first wireless transceiver is substantially compatible with standards under IEEE 802.15.

19. The system of any of claims 16 to 18 wherein the first wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

20. The system of any of claims 16 to 19 wherein the second wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

21. The system of any of claims 16 to 20 wherein the second wireless transceiver is electrically coupled to a user controllable communication device.

22. The system of claim 21 wherein the user controllable communication device is in communication with a user.

23. The system of any of claims 16 to 22 wherein the second wireless transceiver is coupled to a telephone line, a long range transceiver, a cellular

communication network, a narrowband personal communication system network, a modem, a packetized communication network, or the Internet.

24. The system of any of claims 16 to 23 wherein the security device and the first wireless transceiver are battery powered or line voltage powered.

25. A system comprising:

a first module including:

a microprocessor controller;

a lock coupled to the controller;

an audio transducer coupled to the controller, the audio transducer for generating an electrical signal in response to received audio and for generating audio in response to a received electrical signal;

a caller accessible identification module coupled to the controller, the caller accessible identification module for receiving caller entered information;

a proximity detector coupled to the controller, the proximity detector for signaling the presence of a caller near the exterior module; and

a first wireless transceiver coupled to the controller, the first wireless transceiver transmitting a digital signal received from the controller, the first wireless transceiver monitoring a radio frequency for an incoming digital message in a network protocol and for communicating digital data in the network protocol upon receiving an incoming digital message; and

a second module including:

a second wireless transceiver in wireless communication with the first wireless transceiver, the second wireless transceiver monitoring a radio frequency for an incoming digital message in a network protocol and for communicating digital data in the network protocol upon receiving an incoming digital message; and

a user accessible control panel electrically coupled to the second wireless transceiver.

26. The system of claim 25 wherein the first wireless transceiver is substantially compatible with standards under IEEE 802.15.

27. The system of claim 25 or 26 wherein the first wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

28. The system of any of claims 25 to 27 wherein the second wireless transceiver is substantially compatible with standards under IEEE 802.15.

29. The system of any of claims 25 to 28 wherein the second wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

30. The system of any of claims 25 to 29 wherein the first module is battery operated.

31. The system of any of claims 25 to 30 wherein the audio transducer comprises a speaker and a microphone.

32. The system of any of claims 25 to 31 further comprising a third wireless transceiver in communication with the first wireless transceiver and the second wireless transceiver and the third wireless transceiver is further coupled to a long range communication network.

33. The system of any of claims 25 to 32 wherein the first module further comprises a video camera and the second module comprises a video display.

34. The system of any of claims 25 to 33 wherein the proximity detector comprises a doorbell button or a video camera.

35. The system of any of claims 25 to 34 wherein the user accessible identification module comprises a keypad, a biometrics sensor, or a card reader.

36. A device comprising:

a clock;

a wireless transceiver coupled to the clock, the wireless transceiver operable for retransmitting a digital signal, the wireless transceiver monitoring a radio frequency for an incoming digital message in a network protocol and for communicating digital data in the network protocol upon receiving an incoming digital message;

a first control accessible to the user and coupled to the transceiver, wherein actuation of the first control effectuates one of a plurality of user selectable outputs, the user selectable outputs each coupled wirelessly to the device; and

a second control accessible to the user, wherein actuation of the second control selects a time for activating the one of a plurality of user selectable outputs.

37. The device of claim 36 wherein the plurality of user selectable outputs effectuatable by the first control comprises activating a security system, controlling an environmental control, or controlling a premises control.

38. The device of claim 36 or 37 wherein the second control accessible to the user enables the user to select an absolute time, a predetermined time or a default time.

39. The device of any of claims 36 to 38 wherein the wireless transceiver communicates using an omnidirectional communication channel, the wireless transceiver having ad hoc networking capability.

40. The device of any of claims 36 to 39 wherein the wireless transceiver is substantially compatible with standards under IEEE 802.15.

41. The device of any of claims 36 to 40 wherein the wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

42. A method of communicating comprising:

receiving a request for service from a caller using an annunciator module;

transmitting the request as a digital message in a wireless, premises-based network protocol;

receiving the request at a remote location using a personal communication device; and

notifying a user of the device of the received request.

43. The method of claim 42 wherein wirelessly transmitting the request comprises transmitting the encoded request using communication technology substantially compatible with standards under IEEE 802.15.

44. The method of claim 42 or 43 wherein wirelessly transmitting the request comprises transmitting using BLUETOOTH® technical specification version 1.0.

45. The method of any of claims 42 to 44 further comprising:

acknowledging receipt of the signal; and

communicating between the module and the device.

46. The method of any of claims 42 to 45 wherein communicating between the module and the device comprises communicating a video image between the module and the device.

47. The method of any of claims 42 to 46 further comprising:

sending an executable command from the device;

receiving the executable command at the module; and

executing the instruction.

48. The method of claim 47 wherein sending an executable command comprises sending an executable command to operate a door lock.

49. A method, comprising:

entering a predetermined code into a portable transmitter;

transmitting the code as a digital message in a wireless, premises-based network protocol;

receiving the code at a receiver coupled to an operable device;

verifying authorization of the transmitted code; and

operating the device.

50. The method of claim 49 wherein wirelessly transmitting the code as a digital message in a network protocol comprises transmitting using communication technology substantially compatible with standards under IEEE 802.15.

51. The method of claim 49 or 50 wherein transmitting the code as a digital message comprises transmitting using BLUETOOTH® technical specification version 1.0.

52. The method of any of claims 49 to 51 wherein operating the device comprises unlocking a door lock or operating an electric light.

53. A method of operating a security system, comprising:

detecting the position of a bolt;

transmitting information corresponding to the detected position using a wireless radio frequency link in a digital, premises-based network protocol;

receiving the transmitted information; and

operating a security system as a function of the received information.

54. The method of operating a security system of claim 53 wherein operating a security system as a function of the received information comprises operating

perimeter sensors when the bolt is detected in a first position and operating perimeter sensors and interior sensors when the bolt is detected in a second position.

55. The method of operating a security system of claim 53 or 54 further comprising detecting a video image using an interior camera and wherein operating a security system further comprises operating a security system as a function of the bolt position and the detected video image.

56. The method of operating a security system of any of claims 53 to 55 wherein transmitting information corresponding to the detected position using a wireless radio frequency link in a digital network protocol comprises transmitting information corresponding to the detected position using communication technology substantially compatible with standards under IEEE 802.15.

57. The method of operating a security system of any of claims 53 to 56 wherein transmitting information corresponding to the detected position using a wireless radio frequency link in a digital network protocol comprises transmitting information corresponding to the detected position using BLUETOOTH® technical specification version 1.0.

58. A method of remotely operating a security system, comprising,

executing programming on a portable communication device;

generating a visual display of options for controlling the security system;

selecting operational parameters for the security system using the display;

executing a command to implement the selected operational parameters; and

transmitting the command and selected parameters to the security system using a wireless radio frequency link in a digital, premises-based network protocol.

59. The method of claim 58 wherein transmitting the command and selected parameters comprises transmitting the command and selected parameters on a communication channel substantially compatible with standards under IEEE 802.15.

60. The method of claim 58 or 59 wherein transmitting the command and selected parameters comprises transmitting the command and selected parameters using BLUETOOTH® technical specification version 1.0.

61. A building management system comprising:

a transducer for generating data upon detecting a local event;

a first communication module coupled to the transducer, the first communication module including a first transceiver for wirelessly transmitting transducer data in a premises-based, digital network protocol; and

a second communication module for wirelessly communicating with the first communication module, the second communication module further including:

a second transceiver for communicating with the first communication module using the digital network protocol; and

a user operable device coupled to the second transceiver, the user operable device adapted for communicating with the transducer via the digital network protocol.

62. The building management system of claim 61 wherein the first communication module and the second communication module communicate using communication technology substantially compatible with standards under IEEE 802.15.

63. The building management system of claim 61 or 62 wherein the first communication module and the second communication module communicate using BLUETOOTH® technical specification version 1.0.

64. The building management system of any of claims 61 to 63 wherein the first communication module further comprises a controllable member, wherein the controllable member is operated as a function of the user operable device.

65. A method of communicating, comprising:

detecting a user controlled action;

generating encoded data as a function of the user controlled action;

transmitting the encoded data to a remote facility using a premises-based, digital network protocol;

receiving the encoded data at the remote facility; and

initiating an emergency response as a function of the encoded data.

66. The method of claim 65 wherein transmitting the encoded data to a remote facility using a digital network protocol comprises transmitting the encoded data to a remote facility using communication technology substantially compatible with standards under IEEE 802.15.

67. The method of claim 65 or 66 wherein transmitting the encoded data to a remote facility using a digital network protocol comprises transmitting the encoded data to a remote facility using BLUETOOTH® technical specification version 1.0.

68. The method of any of claims 65 to 67 wherein initiating an emergency response comprises summoning fire suppression aid, summoning police service, or summoning medical aid.

69. The method of any of claims 65 to 68 wherein detecting a user controlled action comprises detecting a keystroke, a touch screen input, or an audible command.

70. The method of any of claims 65 to 69 wherein generating encoded data comprises generating encoded data indicative of a fire emergency, a police emergency or a medical emergency.

71. A system comprising:

a passive infrared motion detector; and

a transmitter coupled to the detector, the transmitter is compatible with BLUETOOTH® technical specification version 1.0.

72. The system of claim 71 wherein the transmitter is substantially compatible with standards under IEEE 802.15.

73. The system of claim 71 or 72 further comprising a receiver coupled to the detector, the receiver is compatible with BLUETOOTH® technical specification version 1.0.

74. The system of claim 73 wherein the receiver is substantially compatible with standards under IEEE 802.15.

75. A system comprising:

a passive infrared motion detector; and

a transmitter coupled to the detector, the transmitter is compatible with BLUETOOTH® technical specification version 1.0; and

a long range communication module, the module adapted for communicating with the detector using the transmitter and further wherein the module is coupled to a long range communication network.

76. The system of claim 75 further comprising a receiver coupled to the detector, the receiver compatible with BLUETOOTH® technical specification version 1.0 and wherein the module is adapted for communicating with the detector using the receiver.

77. The system of claim 75 or 76 wherein the long range communication network is a telephone network, a cellular telephone network, a radio network, a personal communication system network, or a two-way pager network.

78. A device comprising:

a processor adapted for coupling to a door opener and having programming including instructions for generating a command to operate the door opener;

a first position sensor coupled to the processor and adapted for generating a first position signal based on a position of a first door coupled to the door opener;

a radio frequency transceiver coupled to the processor and adapted for transmitting the first position signal using a long range communication protocol and a short range communication protocol, and for receiving a wireless signal using the long range communication protocol and the short range communication protocol, the transceiver including circuitry for spread spectrum frequency hopping and wherein the command is based on the wireless signal.

79. The device of claim 78 wherein the transceiver is adapted for communicating on a protocol compatible with a cellular telephone communication protocol.

80. The device of claim 78 or 79 wherein the transceiver is adapted for communicating on a protocol compatible with a pager communication protocol.

81. The device of any of claims 78 to 80 wherein the transceiver operates at a frequency of approximately 2.45 GHZ.

82. The device of any of claims 78 to 81 wherein the transceiver is substantially compatible with standards under IEEE 802.15 or substantially compatible with BLUETOOTH® technical specification version 1.0.

83. The device of any of claims 78 to 82 wherein the first position sensor includes a magnetic switch, a contact switch, or a camera.

84. The device of any of claims 78 to 83 further comprising a battery coupled to the processor and coupled to the transceiver.

85. The device of any of claims 78 to 84 further comprising an optical sensor coupled to the processor and adapted for generating a light level signal based on light intensity in a region proximate to the first door, and further wherein the transceiver is adapted for transmitting the light level signal.

86. The device of any of claims 78 to 85 further comprising a second position sensor coupled to the processor and adapted for generating a second position signal based on a position of a second door, and further wherein the transceiver is adapted for transmitting the second position signal.

87. The device of any of claims 78 to 86 wherein the processor includes programming having instructions for generating a web page accessible from the Internet.

88. The device of any of claims 78 to 87 further comprising an audio transducer coupled to the processor and further wherein the processor includes programming having instructions for operating the door opener in response to a vocal command received by the transducer.

89. A method of manufacturing a module comprising:
adapting a processor to couple with a door opener;
adapting the processor to couple with a first position sensor;
coupling a wireless transceiver adapted for spread spectrum frequency hopping to the processor;

adapting the transceiver to receive a first signal in a protocol compatible with a long range communication protocol and in a protocol compatible with a short range communication protocol;

adapting the transceiver to transmit information received from the first position sensor in a protocol compatible with a long range communication protocol and in a protocol compatible with a short range communication protocol; and

providing a program for executing on the processor, the program having instructions to cause the processor to operate the door opener based on the first signal.

90. The method of claim 89 wherein adapting the transceiver to receive a first signal in a protocol compatible with a long range communication protocol includes adapting the transceiver to receive the first signal in a protocol compatible with a long range cellular telephone communication protocol.

91. The method of claim 89 or 90 wherein adapting the transceiver to receive a first signal in a protocol compatible with a long range communication protocol includes adapting the transceiver to receive the first signal in a protocol compatible with a pager communication protocol.

92. The method of any of claims 89 to 91 further comprising providing a battery connector coupled to the processor and to the transceiver.

93. The method of any of claims 89 to 92 further comprising adapting the processor to couple with a second position sensor and wherein the transceiver is adapted for transmitting information received from the second position sensor.

94. The method of any of claims 89 to 93 further comprising adapting the processor to couple with an optical sensor and wherein the transceiver is adapted for transmitting a light level signal based on light intensity in a region proximate to a door coupled to the door opener.

95. The method of any of claims 89 to 94 further comprising adapting the processor to generate a command to open a door coupled to the door opener in response to an open signal received by the transceiver in a protocol compatible with the long range communication protocol.

96. The method of any of claims 89 to 95 further comprising adapting the processor to generate a command to open a door coupled to the door opener in response to an open signal received by the transceiver in a protocol compatible with the short range communication protocol.

97. The method of any of claims 89 to 96 further comprising adapting the processor to generate a command to close a door coupled to the door opener in response to a close signal received by the transceiver in a protocol compatible with the long range communication protocol.

98. The method of any of claims 89 to 97 further comprising adapting the processor to generate a command to close a door coupled to the door opener in response to a close signal received by the transceiver in a protocol compatible with the short range communication protocol.

99. The method of any of claims 89 to 98 further comprising adapting the processor to generate a web page accessible from the Internet.

100. The method of any of claims 89 to 99 further comprising adapting the processor to couple with an audio transducer and to operate the door opener in response to a vocal command received by the transducer.

101. A method of operating a door comprising:

establishing a wireless communication channel with a module coupled to the door;

transmitting a position signal on the channel based on a position of the door;

providing an indication to a user based on the position signal; and

receiving an instruction signal on the channel, the instruction signal based on a user selected option for operating the door.

102. The method of claim 101 wherein establishing a wireless communication channel with a module coupled to the door includes communicating using a protocol compatible with a cellular telephone, a protocol compatible with a pager or a protocol compatible with BLUETOOTH® technical specification version 1.0.

103. The method of claim 101 or 102 wherein providing an indication to a user based on the position signal includes providing a visual indication.

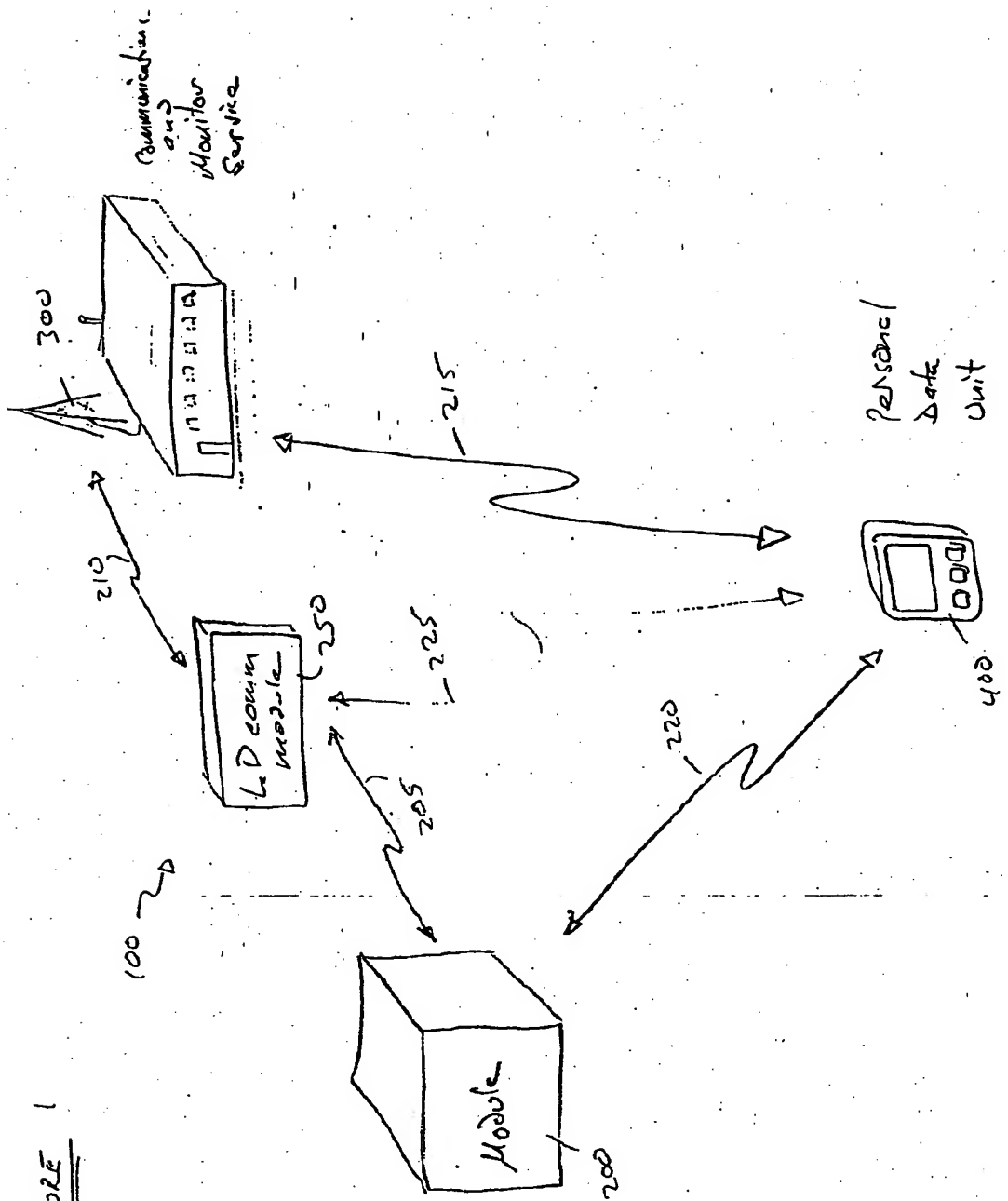


FIGURE 1

Figure 2A

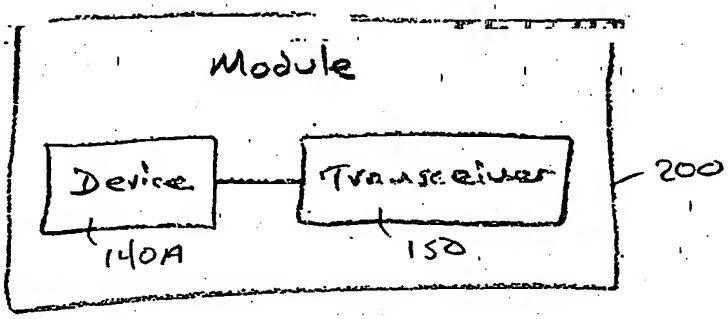


Figure 2B

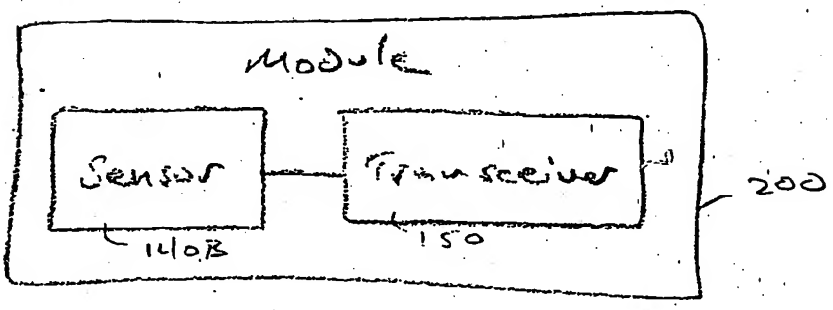


Figure 2C

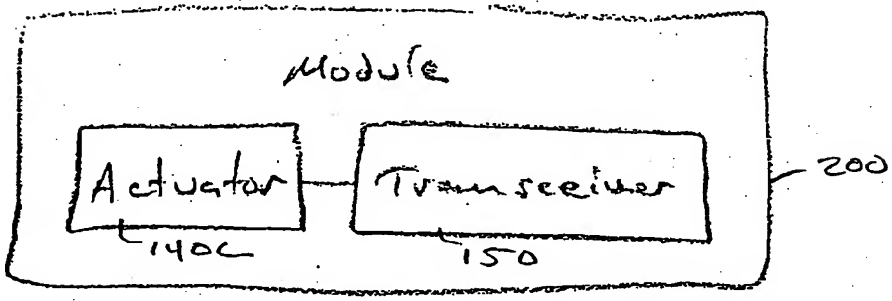
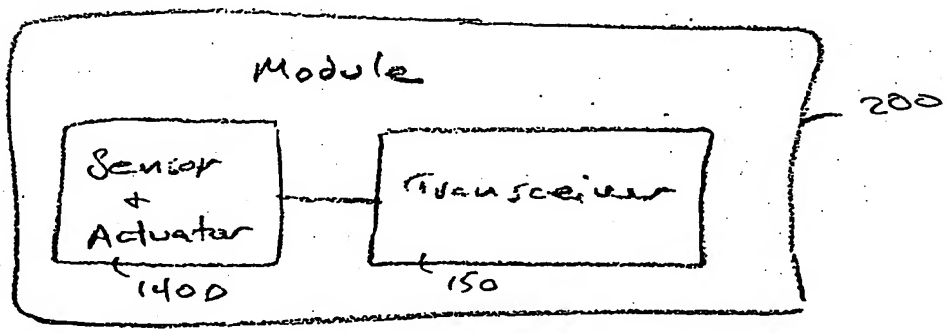


Figure 2D



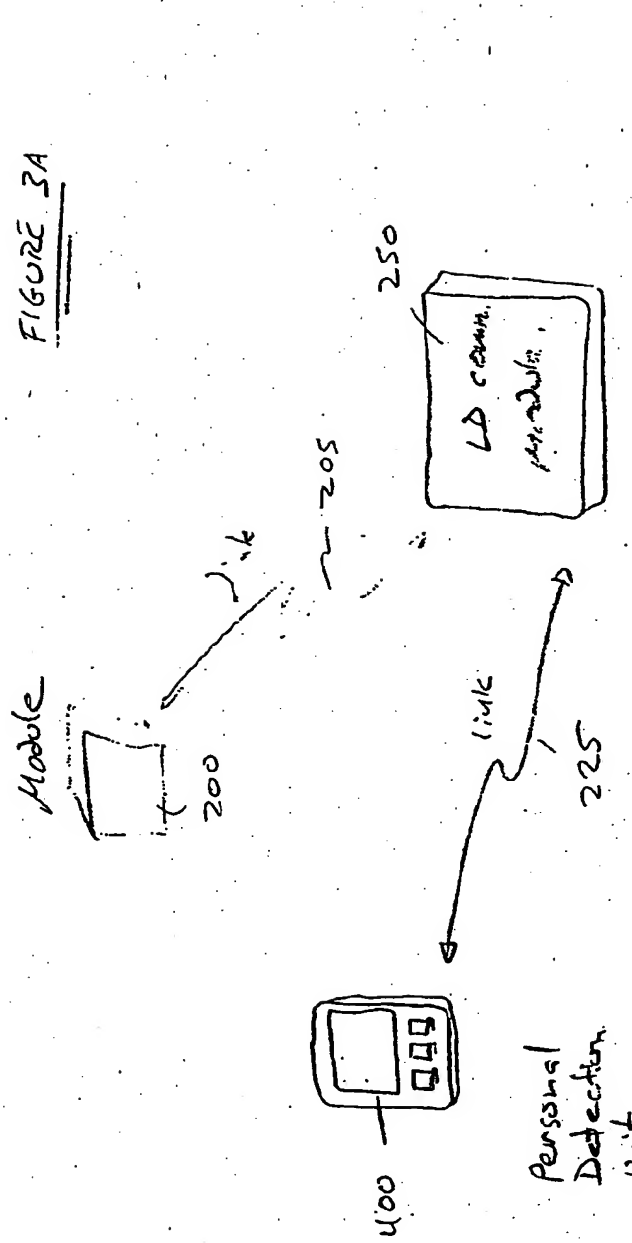


FIGURE 3A

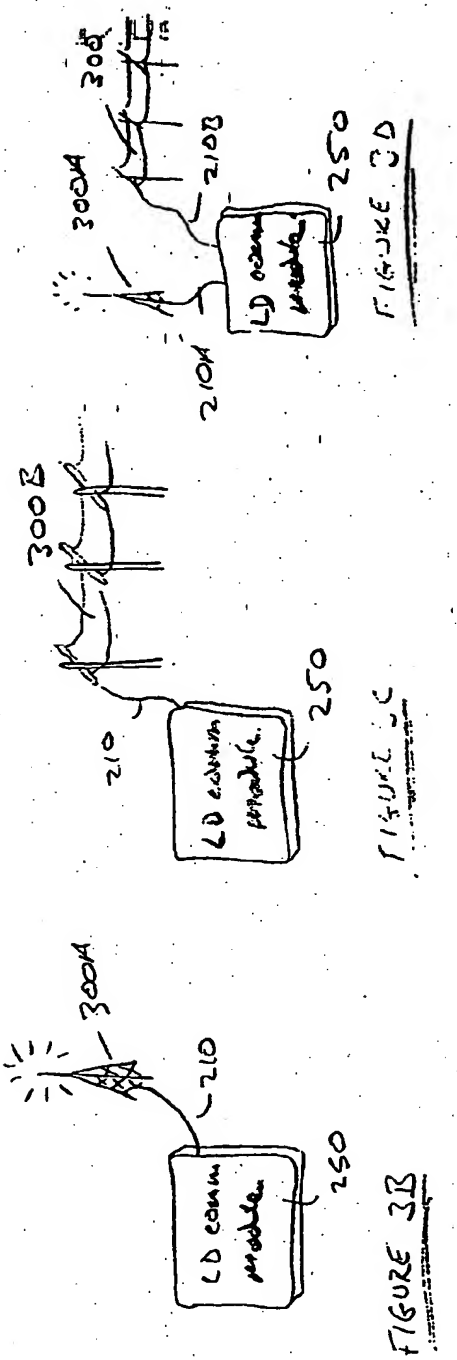


FIGURE 3B

FIGURE 3C

FIGURE 4

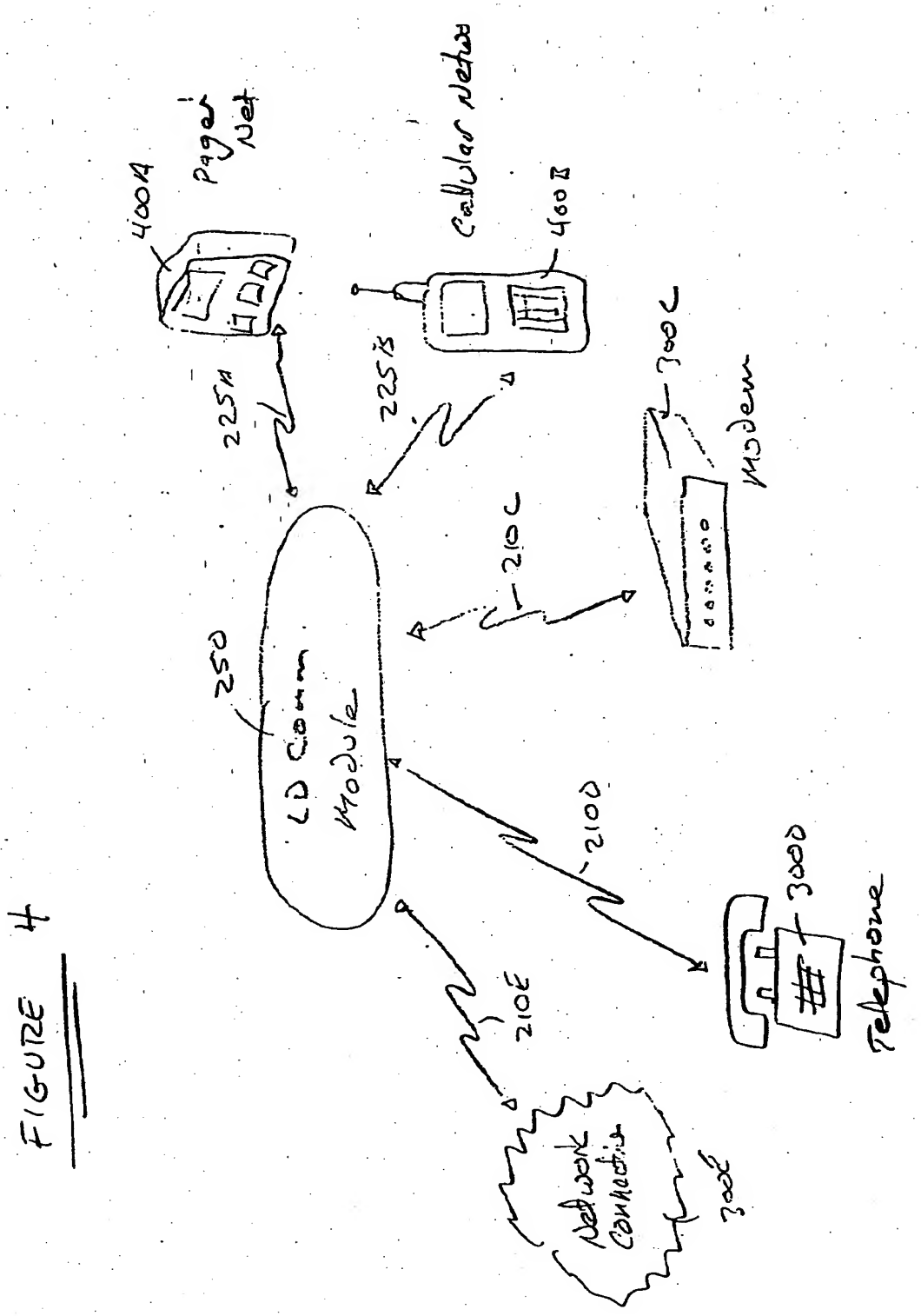
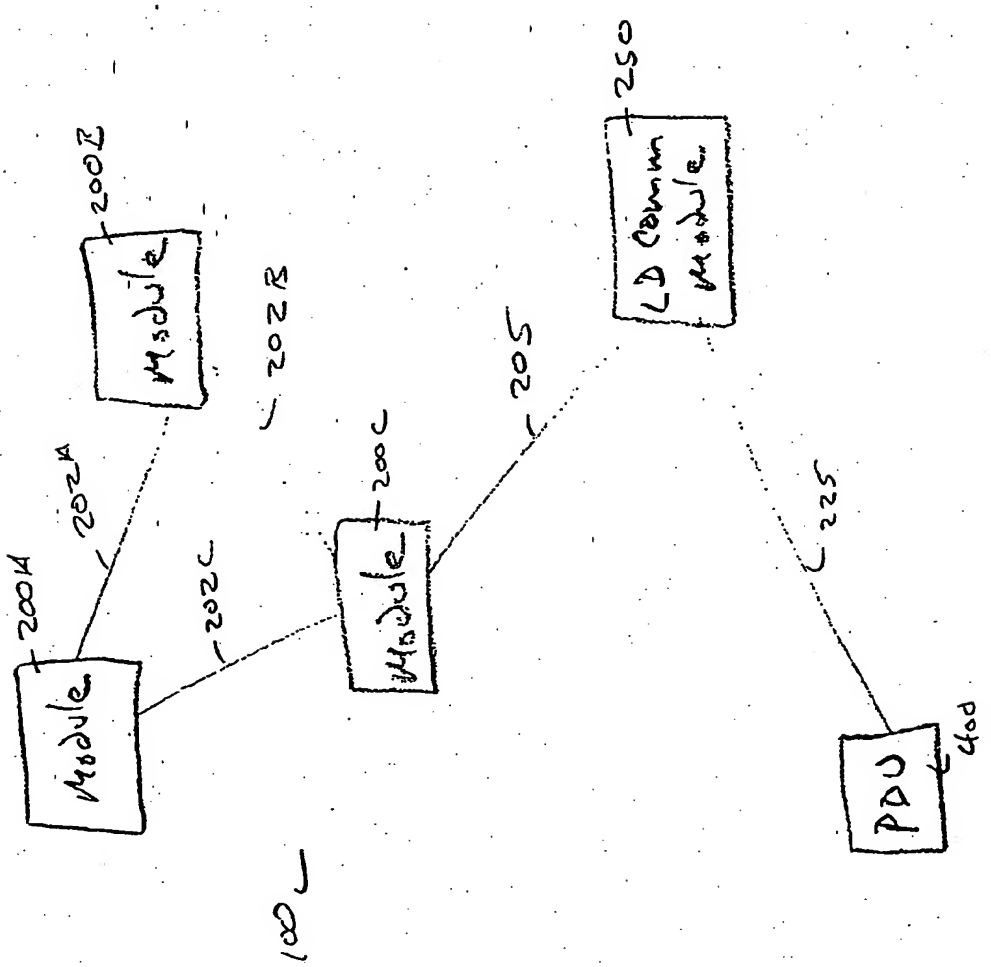
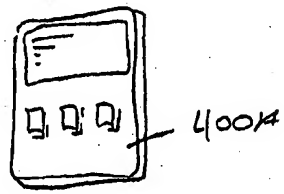


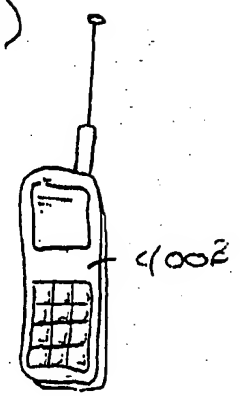
FIGURE 5



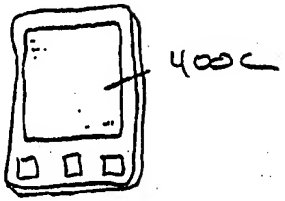
Personal Detection Unit
(Various Embodiments)



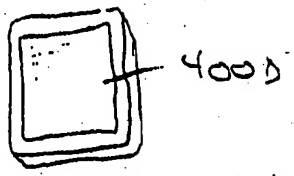
Two-Way Pager
FIGURE 6A



Cellular Telephone
FIGURE 6B



Personal Data Assistant
FIGURE 6C



Personal Communication Device
FIGURE 6D

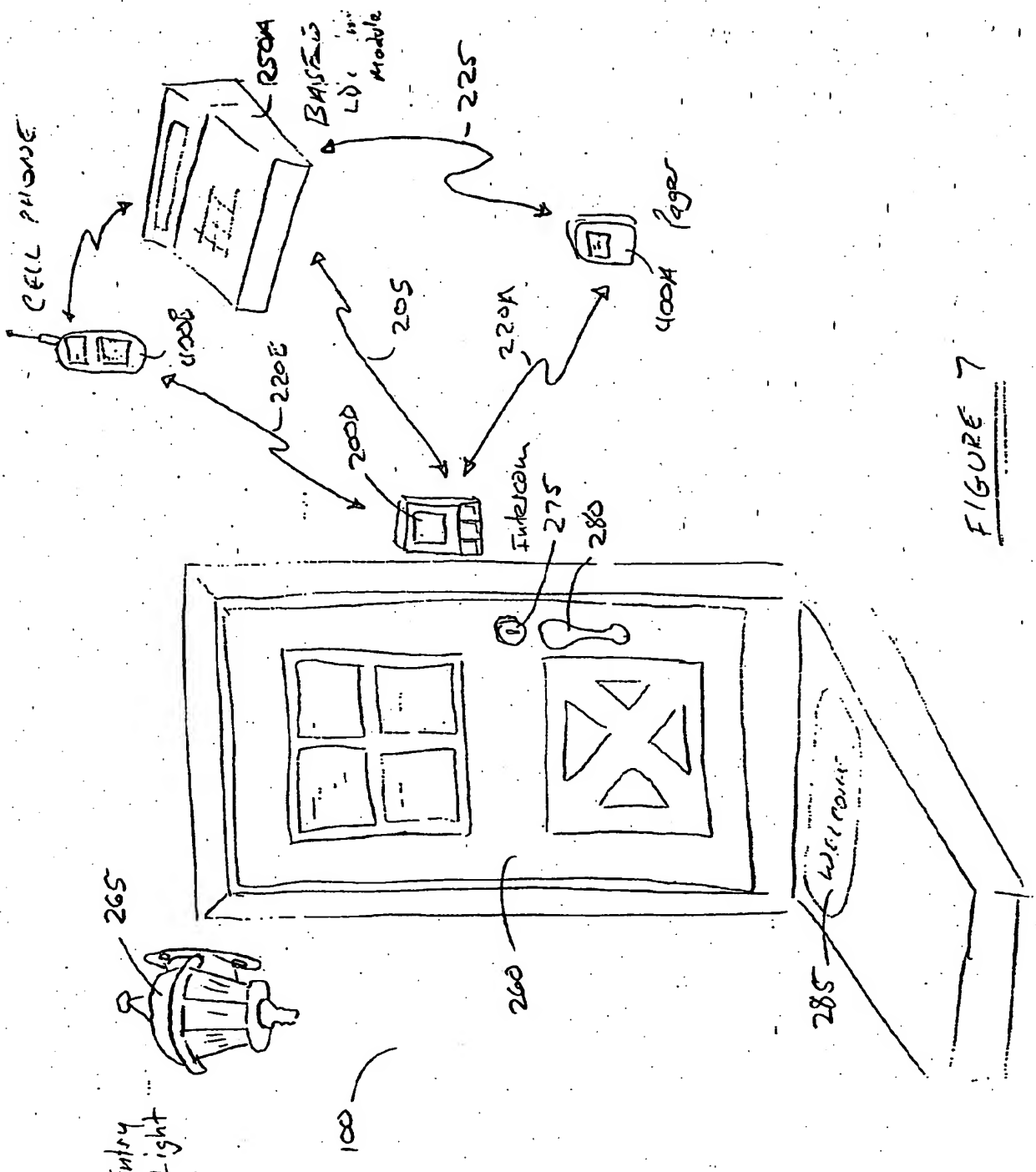
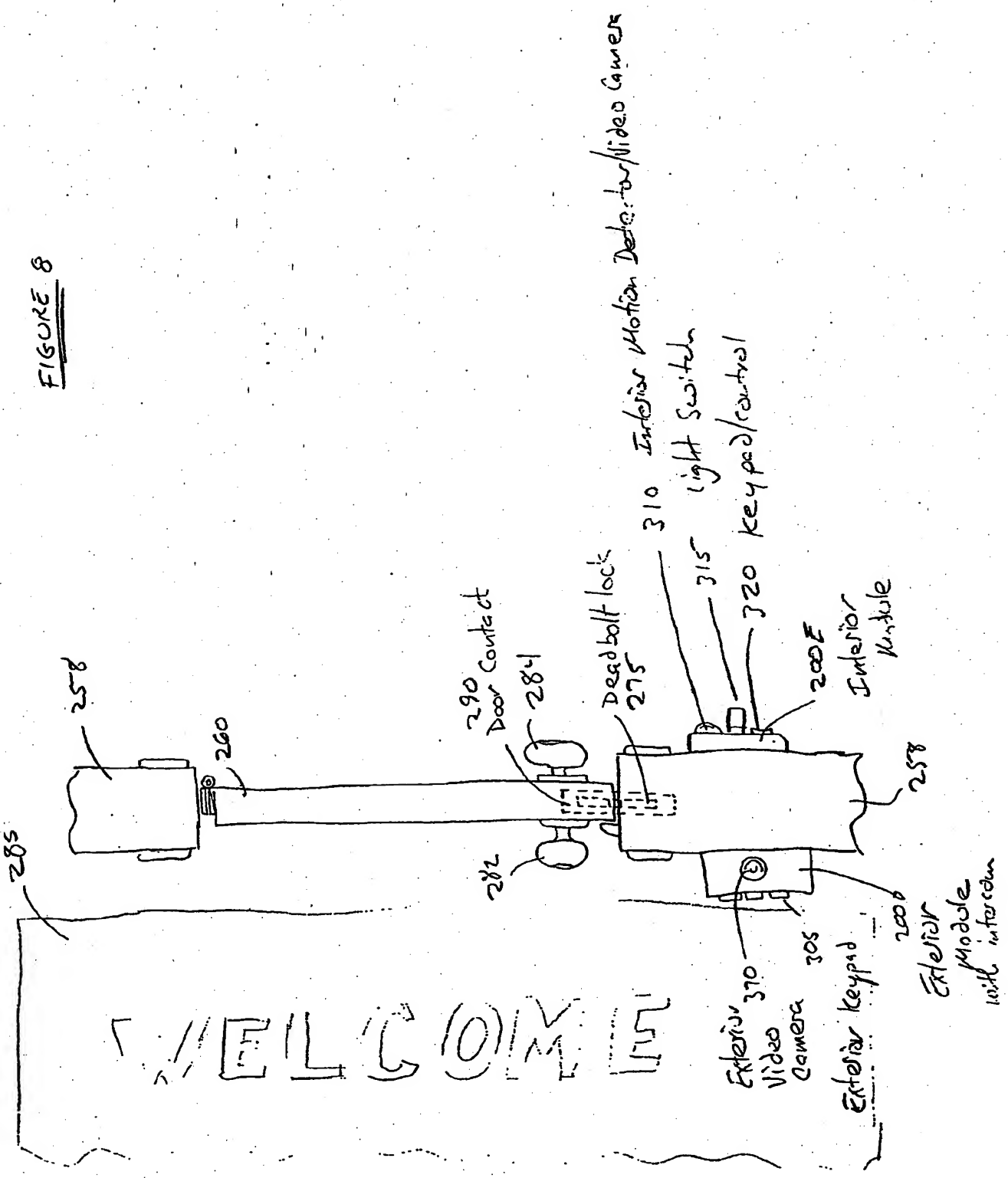


FIGURE 7

FIGURE 8



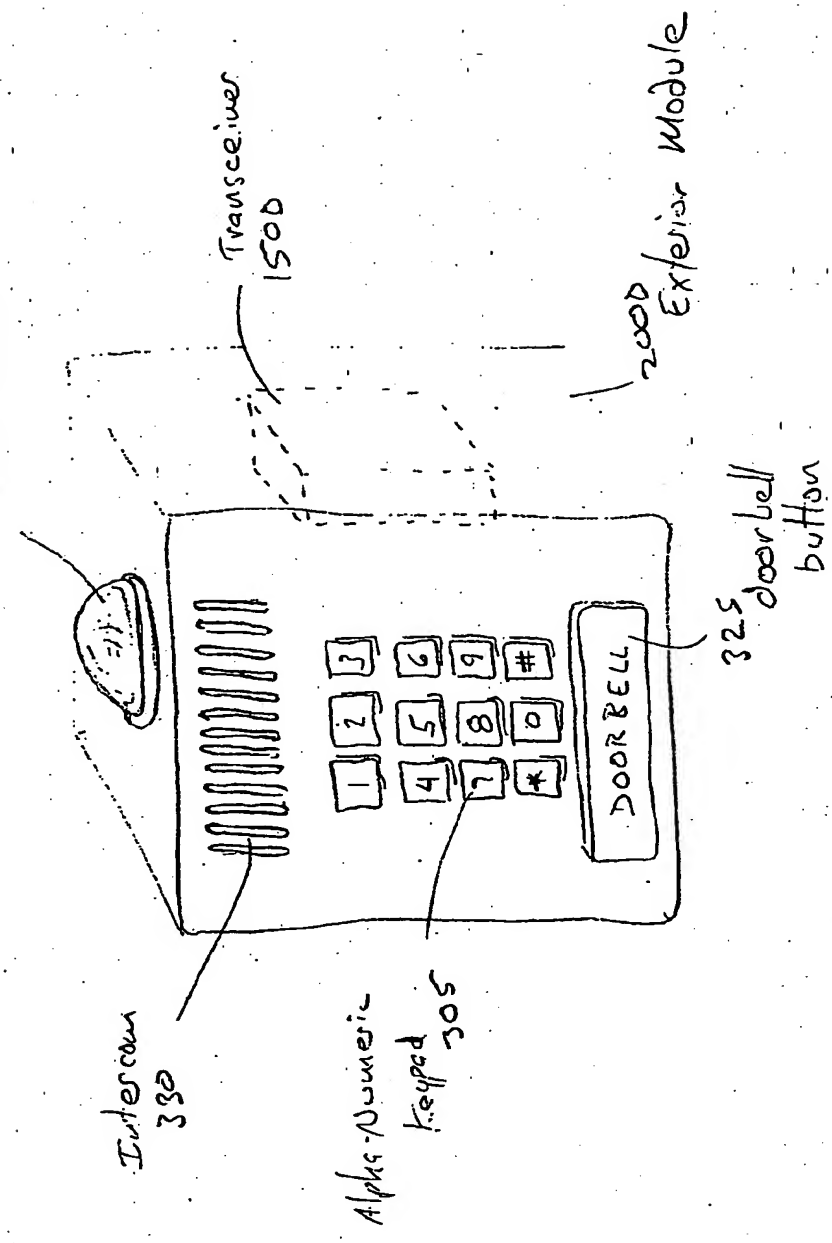


FIGURE 9

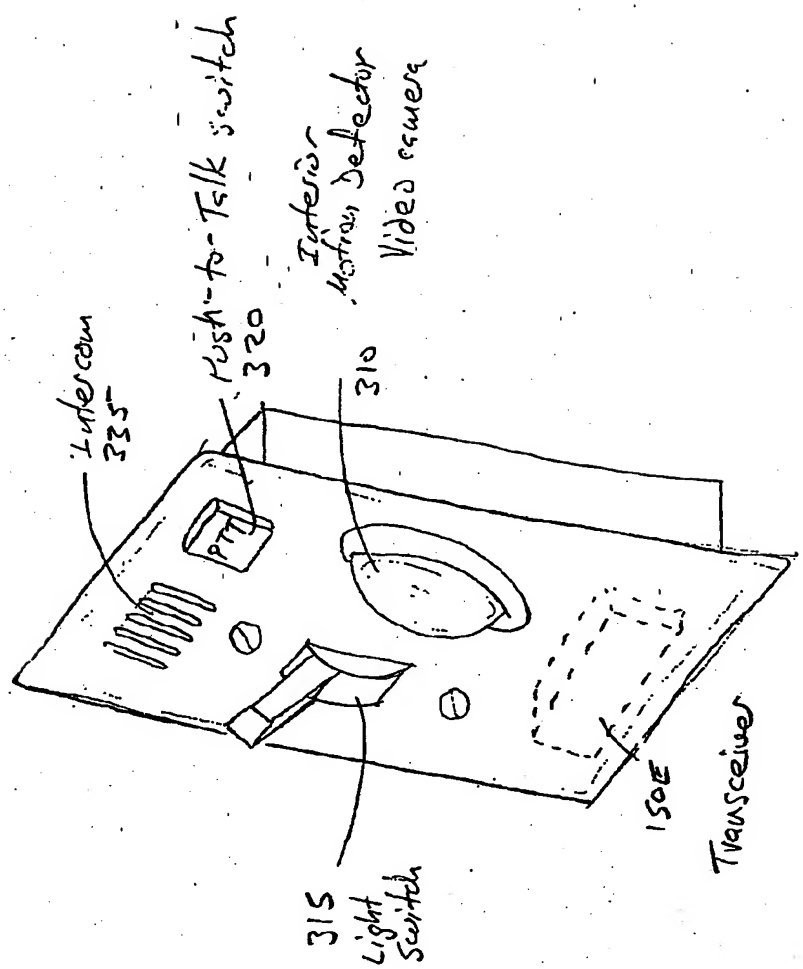


FIGURE 10

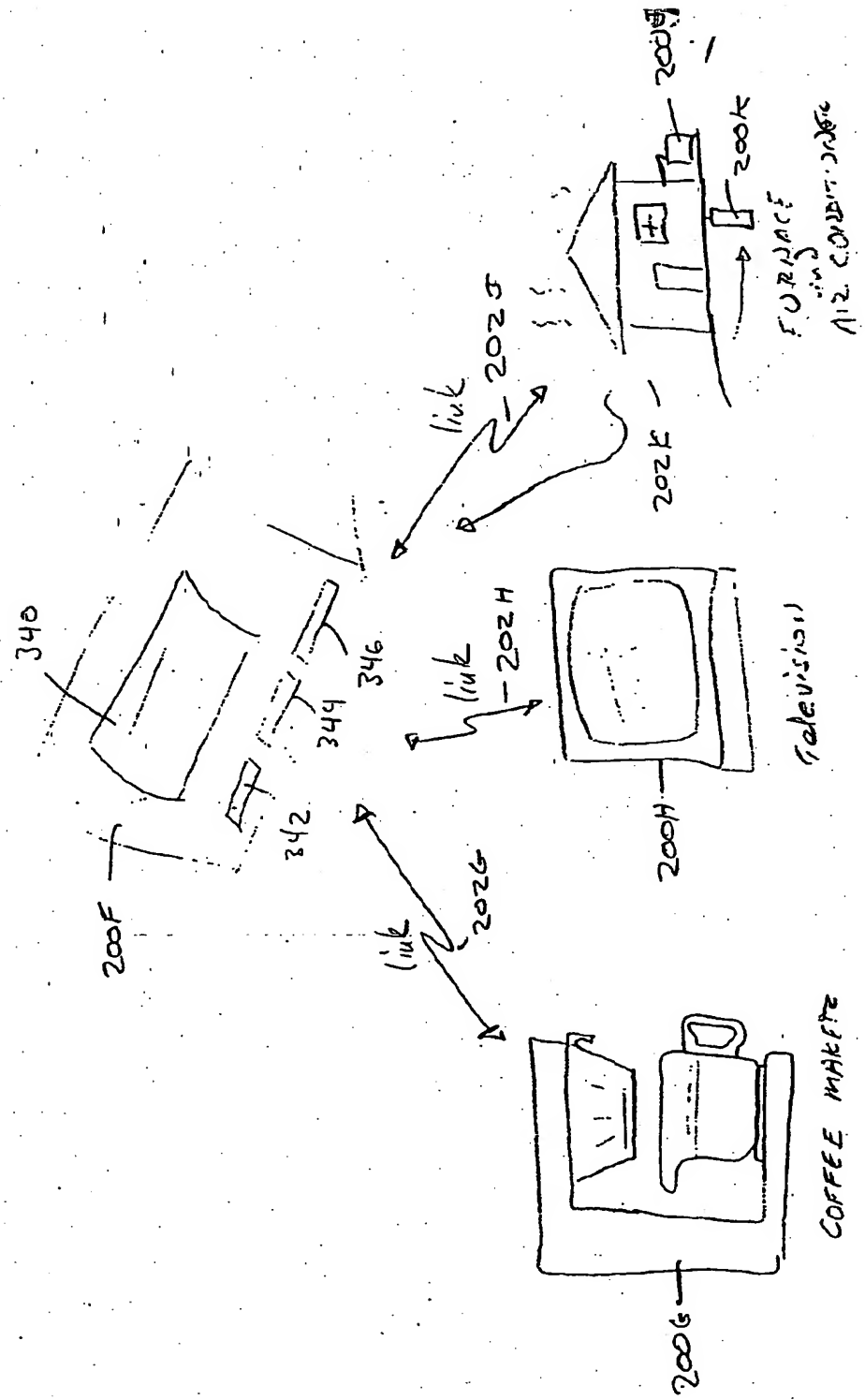


FIGURE 11

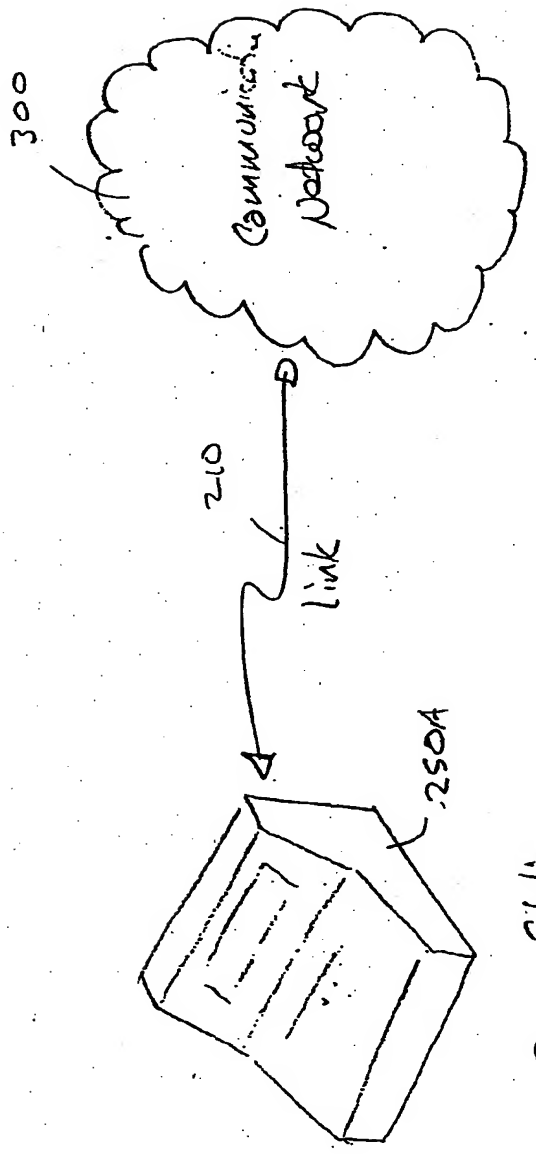


FIGURE 12

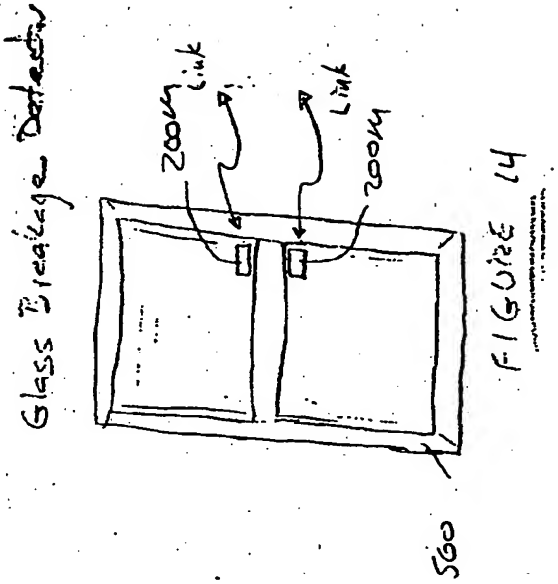


FIGURE 14

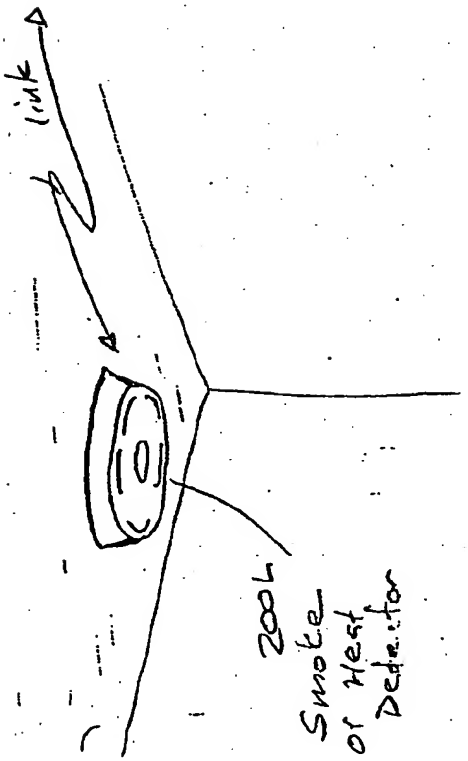


FIGURE 13

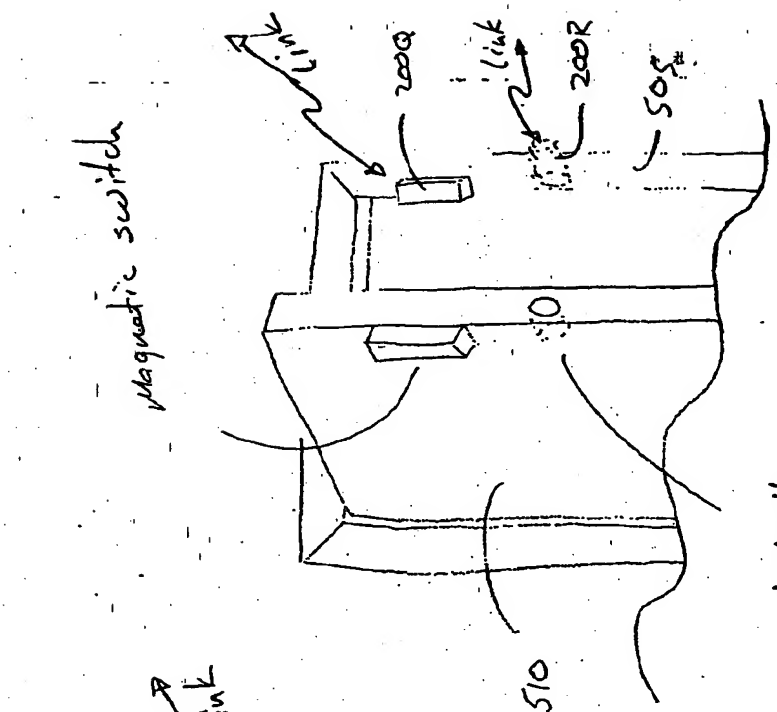


FIGURE 16

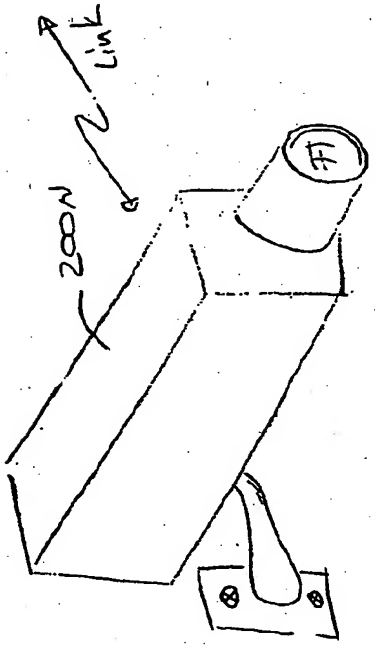


FIGURE 15

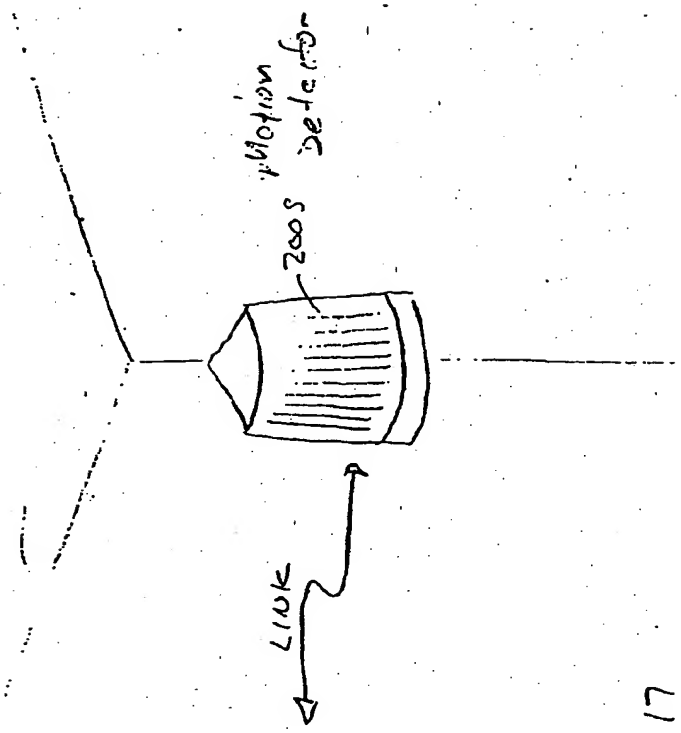


FIGURE 17

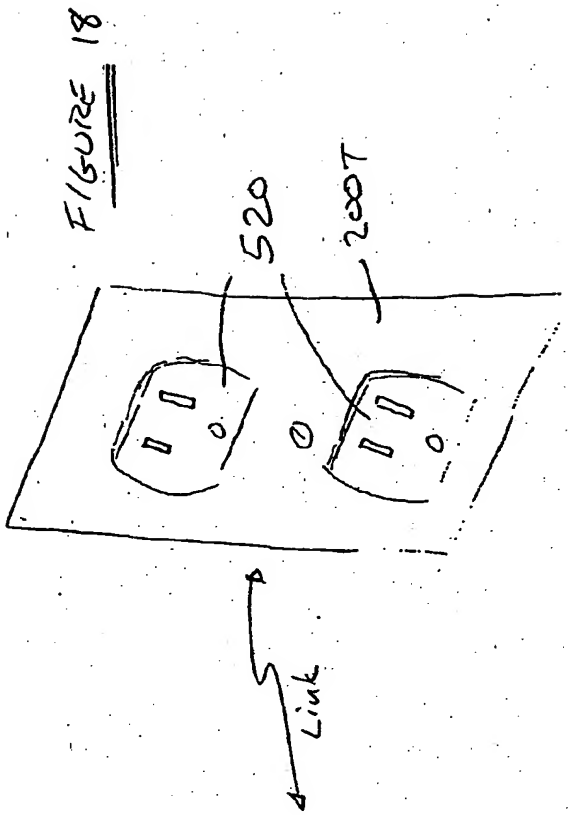


FIGURE 18

FIGURE 19

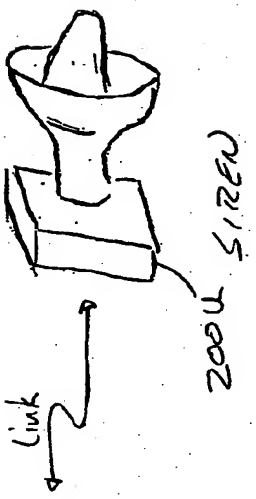


FIGURE 20

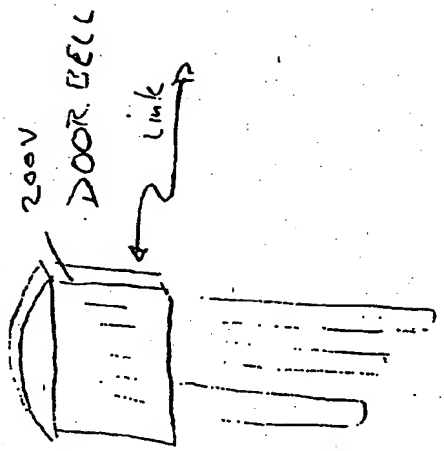


FIGURE 21

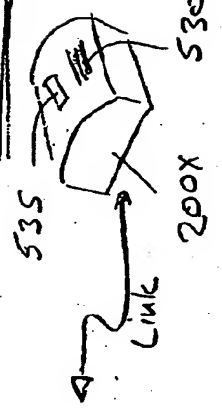
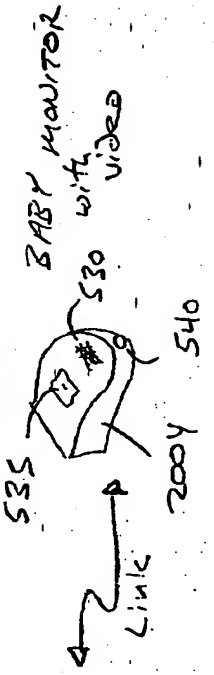


FIGURE 22



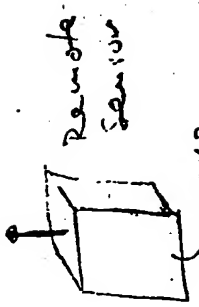


FIGURE 25

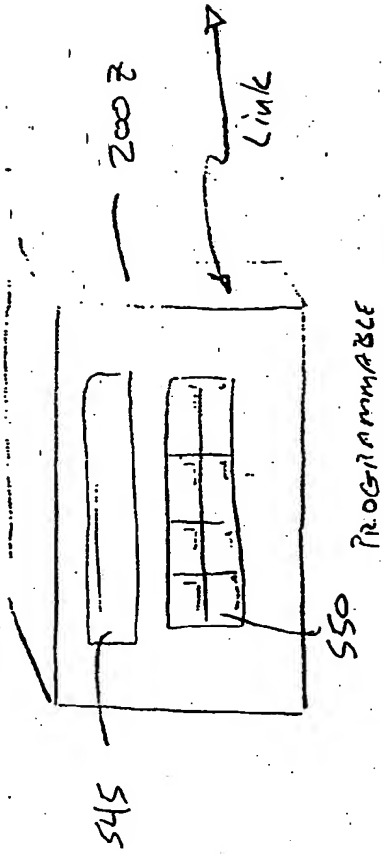


FIGURE 23

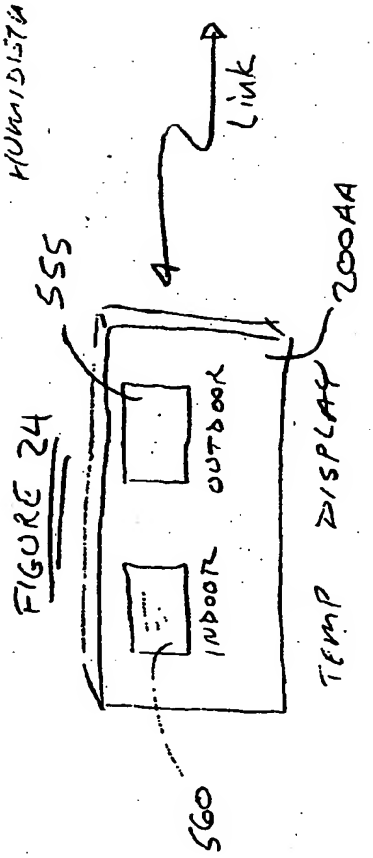


FIGURE 24

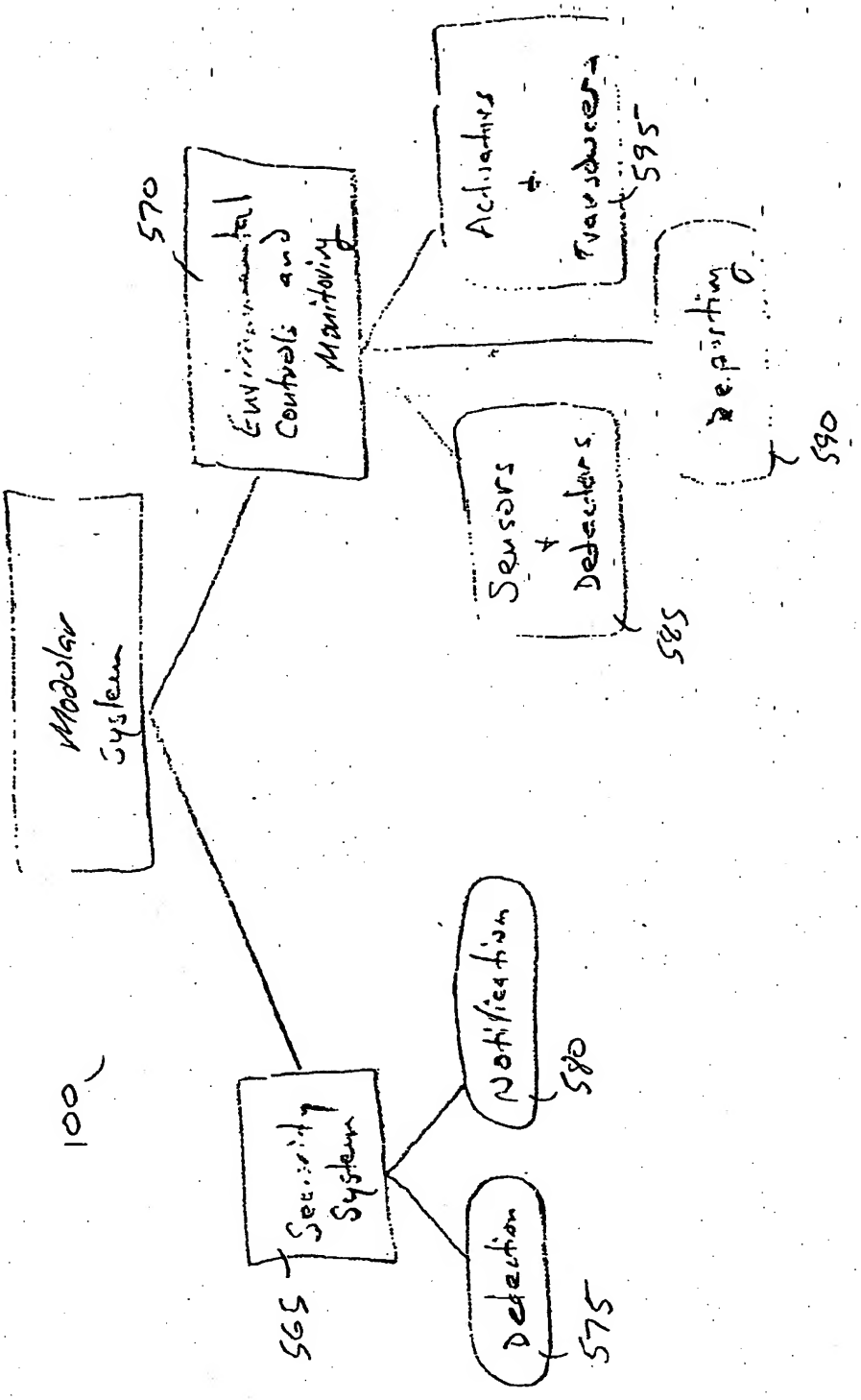
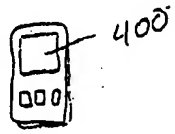
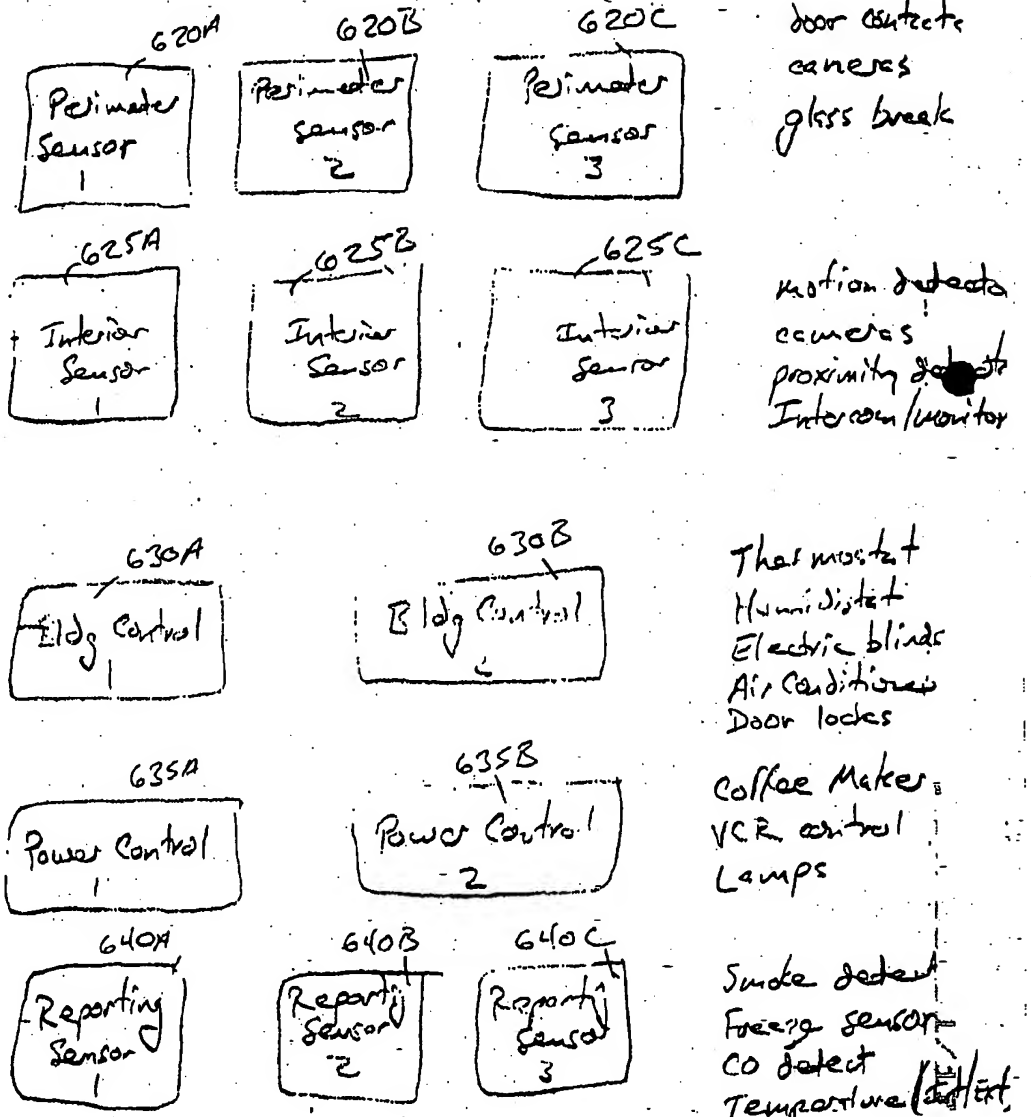


FIGURE 26

FIGURE 27



PDU controls operation & modes of sensors



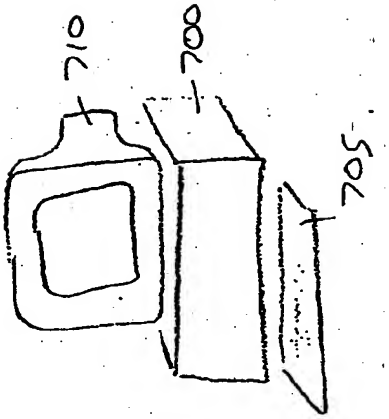


FIGURE 28

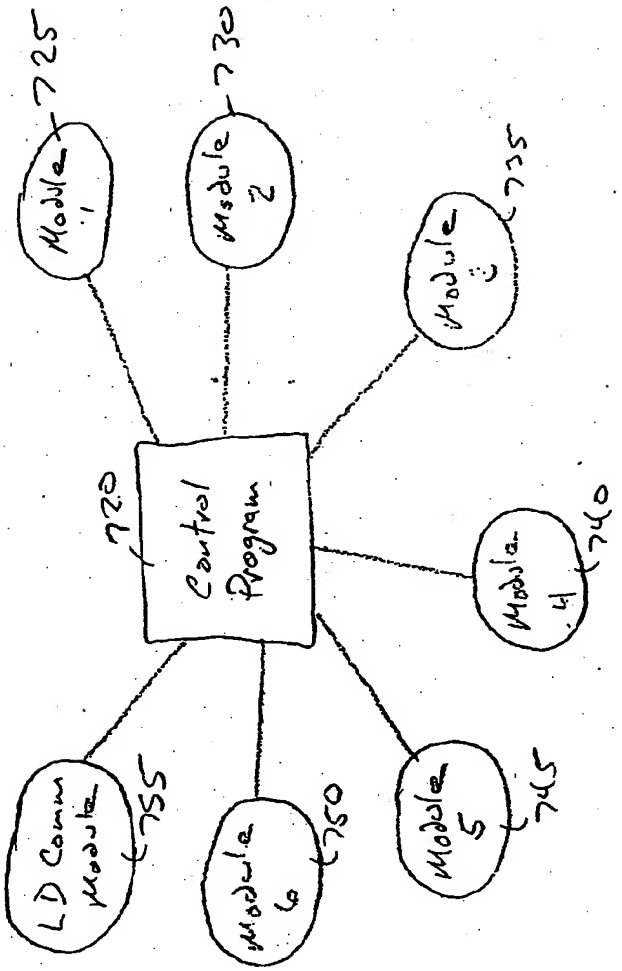


FIGURE 29

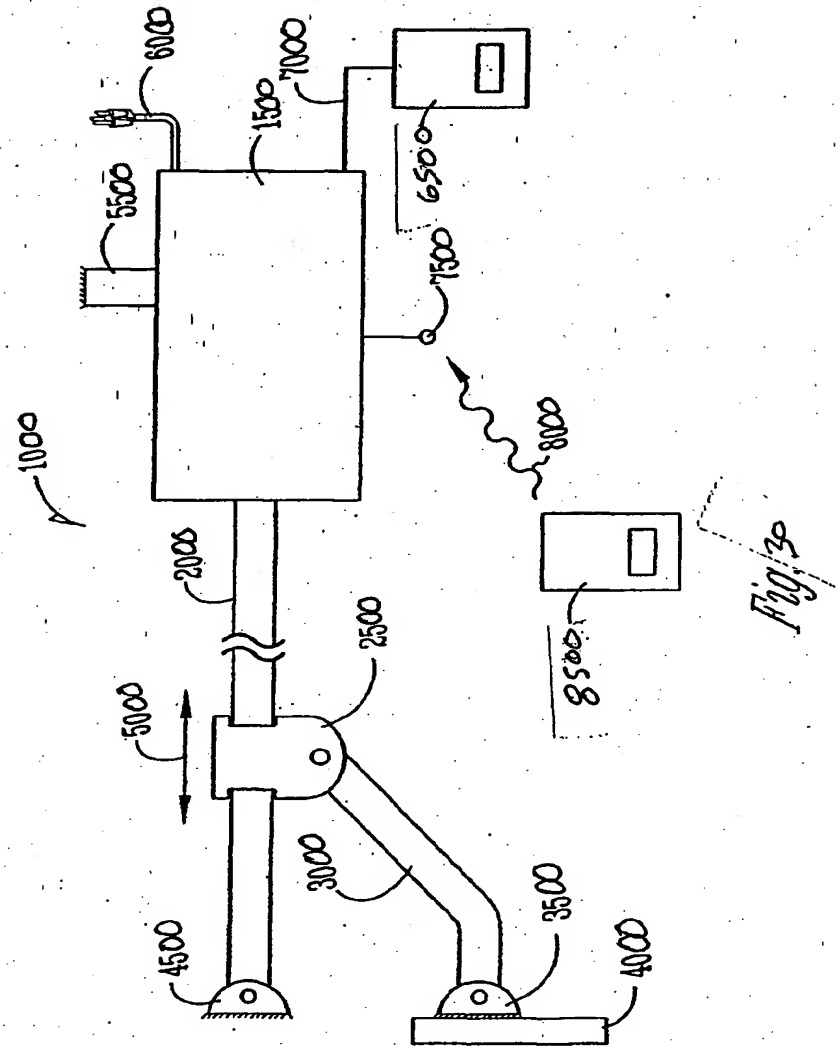


Fig. 30

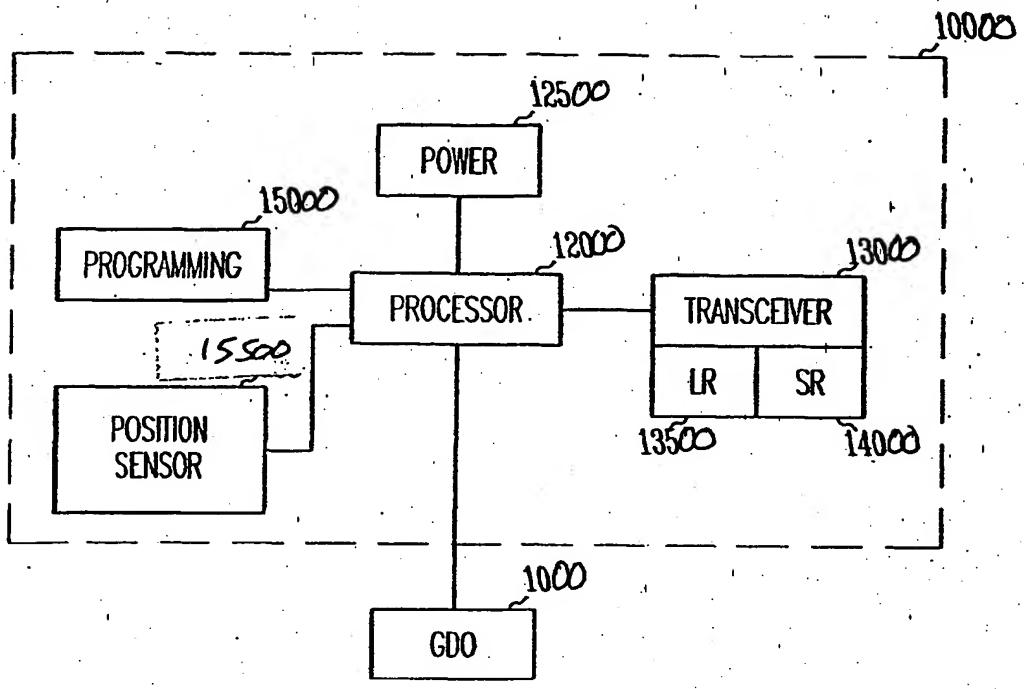


Fig. 31

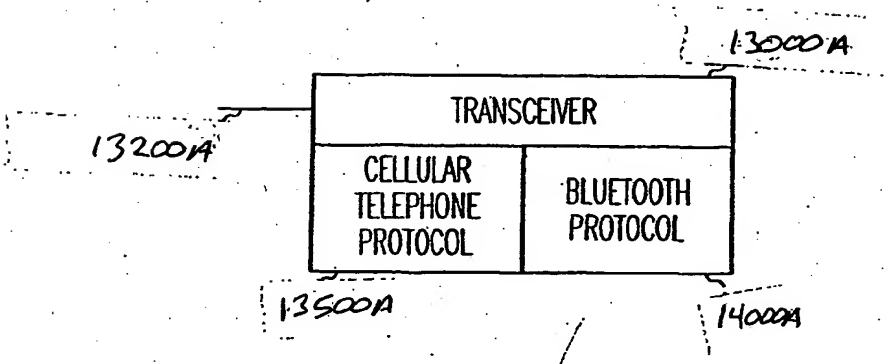


Fig. 32

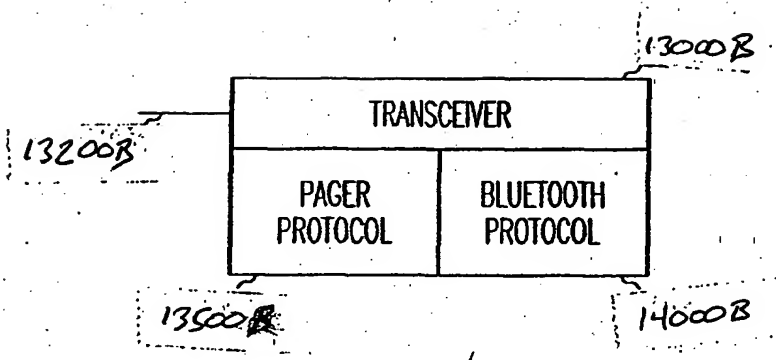


Fig. 33

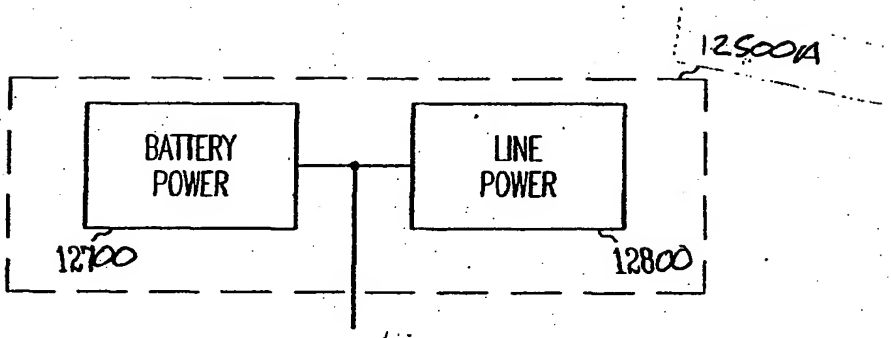


Fig. 34

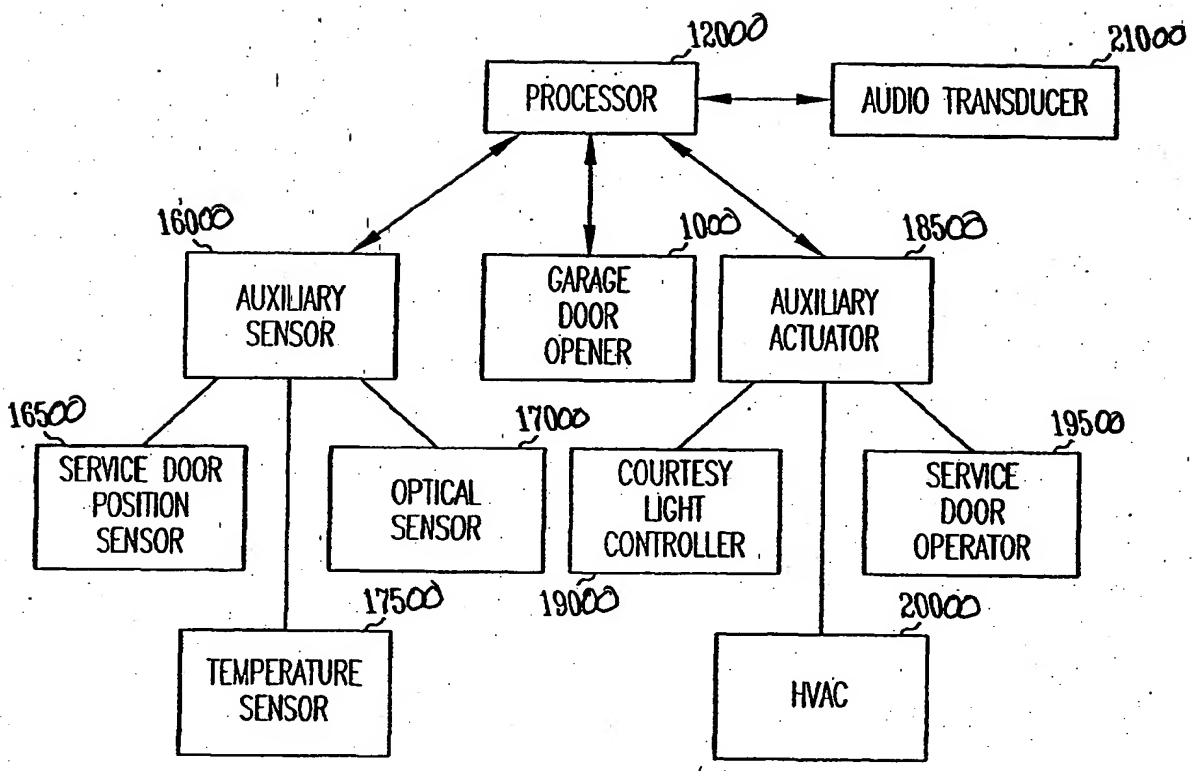


Fig. 35

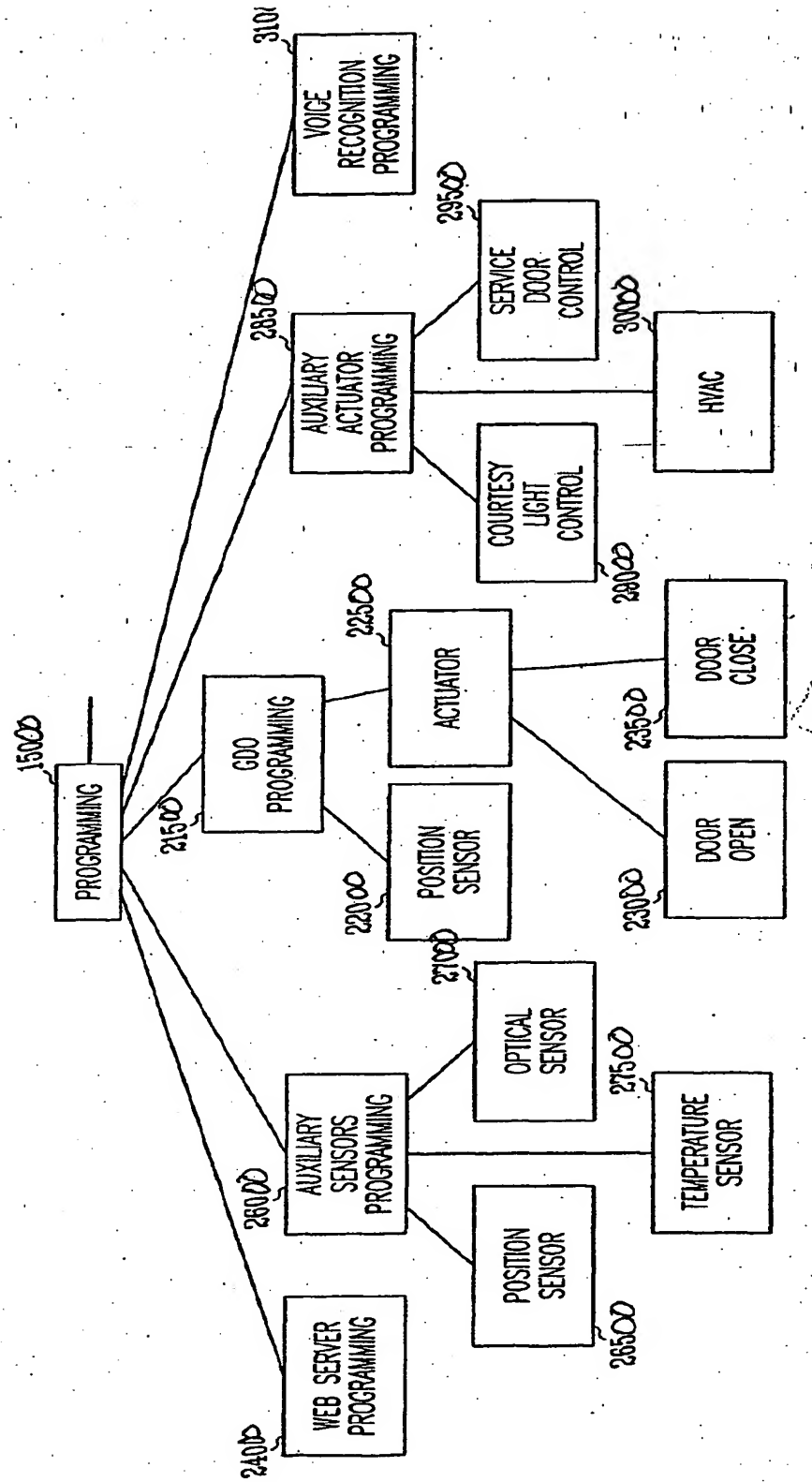


Fig. 36

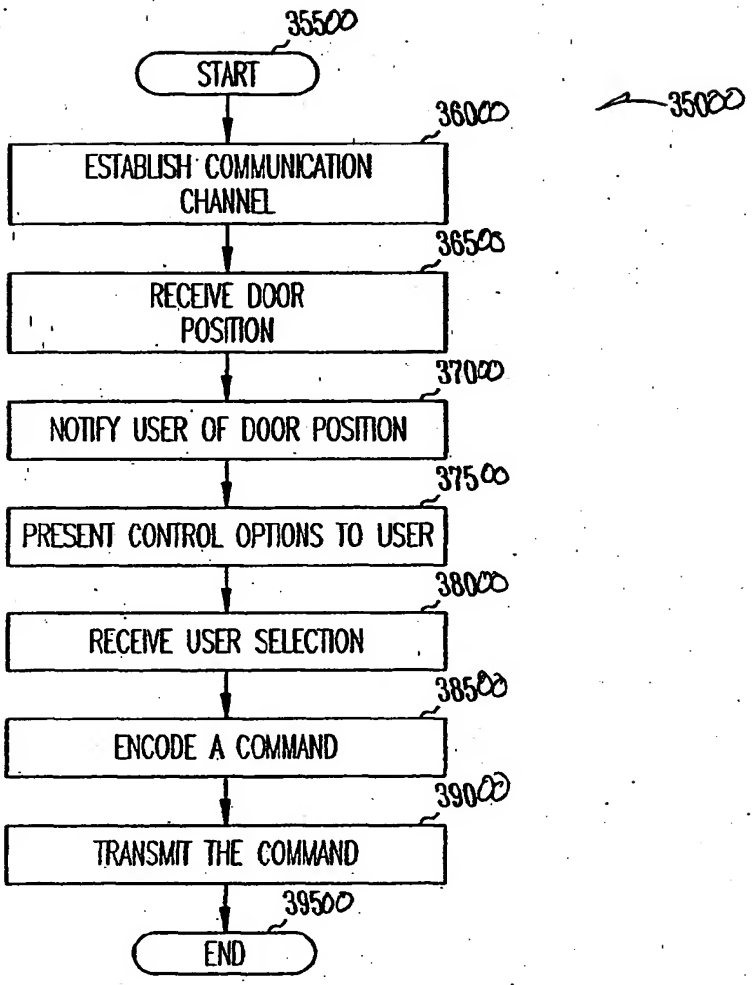


Fig. 37

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International application No.
PCT/US01/17300

A. CLASSIFICATION OF SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,917,405 A (JOAO) 29 June 1999, abstract, lines 1-15	1-103

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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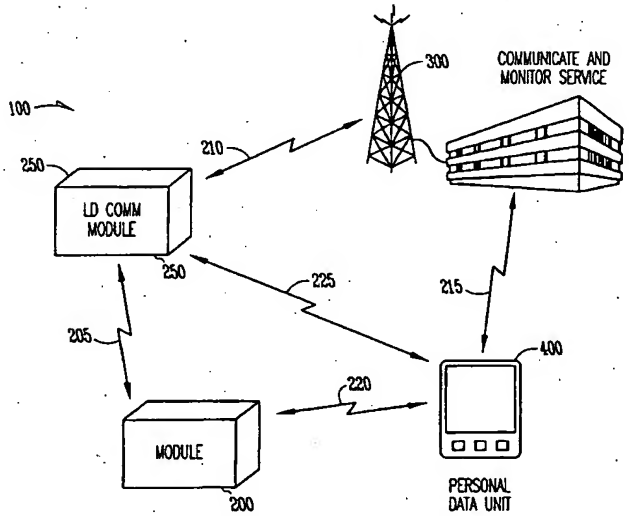
(54) Title: MODULAR COMMUNICATION AND CONTROL SYSTEM AND METHOD



(57) Abstract: A system and method for detecting and monitoring at least one event or condition of interest. The system comprises a sensor and a wireless transmitter and receiver (150). Upon detection of an event of interest, the sensor communicates that information to the transmitter for communication to the receiver. A module with a sensor to indicate the position of a door coupled to a door opener. The module (200) is compatible with a wireless communication protocol and operates over both a long range, such as is used with a cellular telephone, and a short range, such as is used with BLUETOOTH. A door position sensor coupled to the module (200) provides information to the user over a wireless communication channel. In one embodiment, information from an additional door position sensor is wirelessly transmitted. In one embodiment, an audio transducer coupled to the module responds to voice commands to operate the door opener.

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MODULAR COMMUNICATION AND CONTROL SYSTEM AND METHOD

Field of the Invention

The present subject matter relates generally to communication and control systems, and in particular, to a wireless, modular, system suitable for a variety of applications, including building maintenance and control, premises security and personal safety.

Background of the Invention

The variety of separate networks that may exist in a single building creates numerous problems for those purchasing, operating, and maintaining those networks. One example of a typical network is a security system. Another network is a building management or environmental control system. Each of these networks operates using separate controllers, separate network elements, and separate power supplies. With few exceptions, the intranetwork communications of one system are not compatible with those of another system. In addition, the design and installation of such systems are usually proprietary and thus, components from one manufacturer are not compatible with those of another manufacturer. Furthermore, the bandwidth requirements for the communications within each type of network are varied. For example, a security system may require a bandwidth of approximately 1kbit/second, whereas a building management system may require 100kbit/second.

What is needed in the art is improved technology that enables portable, modular, bidirectional communication between a wide variety of devices and that satisfies the demand for a security systems and automated building controls.

Furthermore, what is needed in the art is a system enabling both safety and convenience features in an affordable, modular, arrangement that is easy to install and manage.

In addition, and for reasons of convenience and safety, many overhead garage doors are equipped with an electric door opener. Automobile drivers find it convenient to remotely open and close the overhead door without exiting their car. Homeowners also enjoy the convenience of opening the garage door with a push of a button. Often, a control button is wired directly to the opener and located on an interior surface of a garage wall. Homeowners also find that a properly installed electric garage door opener improves personal safety. Most doors are heavy and, unless operated with appropriate care, can be lethal if dropped on a child. Safety features of modern garage doors, including automatic reverse on obstruction and floor level optical sensors, provide some measure of protection against crushing a person.

However the typical garage door opener suffers from a number of problems. First, garage door openers lack any feedback to indicate the position of the door to the user. Unless the user observes complete closure of the door, there remains the possibility that the door will return to an open position after the user has driven out of view. For example, if a cat runs out of the garage moments before complete closure or if a broom handle falls in the path of the door, the opener will return the door to an open position. An unattended home with an open garage door is an easy target for a burglar. Second, in most cases, the user must use either the proprietary remote control encoded for use with the particular opener or the wired button usually affixed to a wall surface. If the remote control is unavailable, then the user is inconvenienced and forced to use other means to open the door. For example, without a remote control, the user may have to enter the garage using an alternate door or use an external switch. Third, typical garage door openers lack adequate security protection to prevent operation of the door by an unauthorized person. For example, in some cases, the wireless garage door opener access code can be stolen by a third party using code grabbing devices. Using such a device, a thief waiting near the home can copy the wireless access code and later return to burglarize the garage, and in some cases, the home.

A profile schematic of a residential garage door opener system 1000 is illustrated in Figure 30. In the figure, power unit 1500 may include an electric

motor that provides the force to open and close the garage door. Power unit 1500 may include a belt drive, a chain drive, gear train or other power transmission means to convert rotational forces to linear motion. In the typical installation, power unit 1500 is anchored securely to rafters or other ceiling structure in the garage by supporting structure 5500, which may include angle iron or other stock.

Trolley mechanism 2500 travels along track 2000 in the directions shown generally by arrow 5000. Track 2000 is attached at one end to power unit 1500 and attached at the other end to the garage structure at bracket 4500. Actuator arm 3000 is flexibly coupled to trolley 2500 on one end and flexibly coupled to garage door 4000 by bracket 3500. Door 4000 may be fabricated of wood, aluminum, steel, fiberglass or any other material and often includes multiple door panels, each of which is commonly referred to as a section, arranged in a hinged assembly. A section of door is illustrated in Figure 30. The edge of each section of garage door 4000 includes rollers. The rollers engage door tracks mounted along the sides of the door opening.

Switch 6500 is wired directly to power unit 1500 by line 7000. Switch 6500 is often mounted on a wall adjacent to a service door to the garage. Normally, when the button on switch 6500 is pressed, power unit 1500 drives door 4000 to an open position if door 4000 closed, and to a closed position if open. Electrical power to operate in this manner is drawn from line cord 6000 which is typically plugged into a nearby outlet mounted in the ceiling of the garage.

In addition to switch 6500, power unit 1500 can be operated by using remote control 8500. Control 8500 includes a wireless transmitter that broadcasts a signal to power unit 1500 by radio link 8000. In the figure, antenna 7500 is mounted on power unit 1500, however, an antenna may, instead, be located on switch 6500. Control 8500 is most often used by a driver from within an automobile. Control 8500, like switch 6500, causes power unit 1500 to drive door 4000 to an open position if closed, and to a closed position if door 4000 is open.

For the reasons stated above, and for other reasons stated below which will become apparent to those skilled in the art upon reading and understanding the present specification, there is a need in the art for systems and methods to control and manage a door opener system or other device using a controller having an unlimited geographical range, interoperability with other systems, simple programming to enable easy set-up and configuration of the remote control system, and feedback indicating status or mode of operation of the opener or other device.

Summary

The present subject matter provides a system and method to address the aforementioned problems. In one embodiment, the present subject matter provides a security sensor and a wireless transceiver communicating using a network protocol. In one embodiment, the transceiver also retransmits communications using the network protocol. In various embodiments, the transceiver is compatible with an IEEE specification, BLUETOOTH® technical specification 1.0. The sensor may include, but is not limited to, a motion sensor, a passive infrared motion detector, pressure sensor, position sensor, proximity sensor, glass breakage sensor or a video camera. Environmental sensors are also contemplated, either individually or in combination with other sensors. Environmental sensors may include, but are not limited to, a temperature sensor, a gas sensor, a particulate sensor, a fluid sensor, or a sound sensor. The system may also include a control, such as, but not limited to a power control, an appliance control, an air conditioner control, a furnace control, or a ventilation control. The system may also include a an operable security device coupled to the wireless transceiver. Such devices may include, but are not limited to, a lock or a siren. In one embodiment, other wireless transceivers are comprehended and enable relaying of communications. In one embodiment, the wireless transceiver communicates with a long range, bidirectional wireless network, such as, but not limited to, a telephone, a cellular telephone, a pager, a computer, a personal communication service (PCS) device, a narrowband PCS device, a two-way pager, a personal data assistant. The system may be battery powered or powered by metered electric service.

In one embodiment, the system includes a security device, and a first wireless transceiver electrically coupled to the security device, wherein the first wireless transceiver monitors a plurality of radio frequencies, retransmits digital data in a digital network protocol, receives outbound data from the security device and wirelessly transmits the outbound data using the digital network protocol. Furthermore, the transceiver may be adapted for wirelessly receiving incoming digital data in the network protocol and communicating the incoming digital data to the security device. One embodiment includes a second wireless transceiver in communication with the first wireless transceiver, the second wireless transceiver adapted for monitoring the plurality of radio frequencies, receiving and retransmitting digital data in the digital network protocol, communicating outgoing data to a user, and transmitting the incoming digital data. In one embodiment, the transceiver is a spread spectrum transceiver. Either transceiver may be compatible with standards under IEEE 802.15, or compatible with BLUETOOTH® technical specification version 1.0. In one embodiment, the second wireless transceiver is electrically coupled to a user controllable communication device. In one embodiment, the user controllable communication device is in communication with a user. In various embodiments, the second wireless transceiver is coupled to a telephone line, a long range transceiver, a cellular communication network, or a narrowband personal communication system network. In one embodiment, the system is coupled to a modem or a packetized communication network, such as the Internet. Various portions of the system may be battery powered or line voltage powered.

In one embodiment, the system includes a first module and a second module. The first module may include a microprocessor controller, a lock coupled to the controller, an audio transducer coupled to the controller, the audio transducer for generating an electrical signal in response to received audio and for generating audio in response to a received electrical signal, a caller accessible identification module coupled to the controller, the caller accessible identification module for receiving caller entered information, a proximity detector coupled to the controller, the proximity detector for signaling the

presence of a caller near the exterior module; and a first wireless transceiver coupled to the controller, the first wireless transceiver transmitting a digital signal received from the controller, the first wireless transceiver monitoring a radio frequency for an incoming digital message in a network protocol and for communicating digital data in the network protocol upon receiving an incoming digital message. The second module may include a second wireless transceiver in wireless communication with the first wireless transceiver, the second wireless transceiver monitoring a radio frequency for an incoming digital message in a network protocol and for communicating digital data in the network protocol upon receiving an incoming digital message and a user accessible control panel electrically coupled to the second wireless transceiver. In one embodiment, the audio transducer comprises a speaker and a microphone. In one embodiment, the first module includes a video camera and the second module includes a video display. In one embodiment, the proximity detector comprises a doorbell button or a video camera. In one embodiment, the user accessible identification module includes a keypad, a biometrics sensor, or a card reader.

In one embodiment, the system comprises a clock and a transceiver coupled to the clock and a first control accessible to the user and coupled to the transceiver, wherein actuation of the first control effectuates one of a plurality of user selectable outputs, the user selectable outputs each coupled wirelessly to the device, and a second control accessible to the user, wherein actuation of the second control selects a time for activating the one of a plurality of user selectable outputs. In one embodiment, the outputs activate a security system or controls an environmental control, or controls a premises control. In one embodiment, the user can select an absolute time, a time relative to a predetermined time, or a default time. In one embodiment, the transceiver communicates omnidirectionally and is adapted for ad hoc networking capability.

In one embodiment, the present subject matter describes a method including receiving a request for service from a caller using an annunciator module, transmitting the request as a digital message in a wireless, premises-

based network protocol, receiving the request at a remote location using a personal communication device, and notifying a user of the device of the received request. In one embodiment, the method includes acknowledging receipt of the signal and communicating between the module and the device. In one embodiment, the method includes communicating a video image between the module and the device. In one embodiment, the method includes sending an executable command from the device, receiving the executable command at the module, and executing the instruction. In one embodiment, the method includes sending an executable command to operate a door lock.

In one embodiment, the method includes entering a predetermined code into a portable transmitter, transmitting the code as a digital message in a wireless, premises-based network protocol, receiving the code at a receiver coupled to an operable device, verifying authorization of the transmitted code, and operating the device. In one embodiment, the method includes unlocking a door lock or operating an electric light.

In one embodiment, the method includes detecting the position of a bolt, transmitting information corresponding to the detected position using a wireless radio frequency link in a digital, premises-based network protocol, receiving the transmitted information, and operating a security system as a function of the received information. In one embodiment, the method includes operating perimeter sensors when the bolt is detected in a first position and operating perimeter sensors and interior sensors when the bolt is detected in a second position. In one embodiment, the method includes operating a security system as a function of the bolt position and the detected video image.

In one embodiment, the method includes executing programming on a portable communication device, generating a visual display of options for controlling the security system, selecting operational parameters for the security system using the display, executing a command to implement the selected operational parameters, and transmitting the command and selected parameters to the security system using a wireless radio frequency link in a digital, premises-based network protocol.

In one embodiment, a system includes a transducer for generating data upon detecting a local event, a first communication module coupled to the transducer, the first communication module including a first transceiver for wirelessly transmitting transducer data in a premises-based, digital network protocol, and a second communication module for wirelessly communicating with the first communication module, the second communication module further including a second transceiver for communicating with the first communication module using the digital network protocol, and a user operable device coupled to the second transceiver, the user operable device adapted for communicating with the transducer via the digital network protocol. In one embodiment, a controllable member is operated as a function of the user operable device.

In one embodiment, the method includes detecting a user controlled action, generating encoded data as a function of the user controlled action, transmitting the encoded data to a remote facility using a premises-based, digital network protocol, receiving the encoded data at the remote facility, and initiating an emergency response as a function of the encoded data. In one embodiment, the method includes summoning fire suppression aid, summoning police service or summoning medical aid. In one embodiment, the method includes detecting a keystroke, detecting a touch screen input or detecting an audible command. In one embodiment, the method includes generating encoded data indicative of a fire emergency, a police emergency, or a medical emergency.

In one embodiment, the system includes a passive infrared motion detector and a transmitter coupled to the detector, the transmitter is compatible with BLUETOOTH® technical specification version 1.0. In one embodiment, the system includes a receiver coupled to the detector, the receiver is compatible with BLUETOOTH® technical specification version 1.0. In one embodiment, the system includes a long range communication module, the module adapted for communicating with the detector using the transmitter and further wherein the module is coupled to a long range communication network. In one embodiment, the long range communication network is a telephone network, a cellular telephone network, a radio network, a personal communication system network, or a two-way pager network.

In addition, the above mentioned problems with door openers and other problems are addressed by the present invention and which will be understood by reading and studying the following specification. A system and method is described which allows remote control and management of single or multiple door openers using a wired or wireless communication device. The device may be a cellular telephone, a pager, a personal digital assistant, a computer or other device that communicates using a network.

In particular, an illustrative embodiment of the present invention includes a processor executing programming and coupled to a door opener, a position sensor, and a wireless transceiver that communicates using both a long range communication protocol and a short range communication protocol. A user need not specify the communication protocol to be used in controlling or managing the opener. The opener receives commands and transmits status information using either or both of the long range and short range protocols. In one embodiment, the system detects the presence of a short range protocol device, disables long range communications, and engages in short range communications with the detected device. When the distance between the device and the door opener exceeds the effective range of the short range device, the system terminates short range communications and establishes a communication link using a long range communication protocol. The communication link, whether long range or short range, provides a channel for communicating information from the door opener to the device and for communicating instructions from the device to the door opener.

Position information is transmitted to the device by a transceiver coupled to the processor. Other information, such as temperature or light levels, may also be transmitted to the device.

The present subject matter provides a system and method to address the aforementioned problems and others not expressly stated in this detailed description. In one embodiment, an assisted personal communication system, including a two way pager or other bidirectional, long range, communication device, is used in conjunction with a response agency to coordinate a request for assistance by a user. In one embodiment, the system is used for children to

report an emergency, or other situation, and to coordinate assistance efforts by the response agency.

These and other features and advantages of the invention will become apparent from the following description of the embodiments of the invention.

Description of the Figures

Figure 1 is a diagram showing one embodiment of the present system.

Figure 2A is a diagram showing one embodiment of the present system.

Figure 2B is a diagram showing one embodiment of the present system.

Figure 2C is a diagram showing one embodiment of the present system.

Figure 2D is a diagram showing one embodiment of the present system.

Figure 3A is a diagram showing the operation of one embodiment of the long distance communication module.

Figure 3B is a diagram showing the operation of one embodiment of the long distance communication module.

Figure 3C is a diagram showing the operation of one embodiment of the long distance communication module.

Figure 3D is a diagram showing the operation of one embodiment of the long distance communication module.

Figure 4 is a diagram showing various modes of communication with one embodiment of the present system.

Figure 5 is a diagram showing communication routes within one embodiment of the present system.

Figure 6A is a diagram showing one embodiment of a personal detection unit.

Figure 6B is a diagram showing one embodiment of a personal detection unit.

Figure 6C is a diagram showing one embodiment of a personal detection unit.

Figure 6D is a diagram showing one embodiment of a personal detection unit.

Figure 7 is an isometric view of an entry door with one embodiment of the present system.

Figure 8 is a top view of an entry door with one embodiment of the present system.

Figure 9 is an isometric view of one embodiment of the present system.

Figure 10 is an isometric view of one embodiment of the present system.

Figure 11 is a diagram of one embodiment of the present system.

Figure 12 is a diagram of a portion of one embodiment of the present system.

Figure 13 is an isometric view of one embodiment of the present system.

Figure 14 is a view of one embodiment of the present system.

Figure 15 is an isometric view of one embodiment of the present system.

Figure 16 is an isometric view of a portion of one embodiment of the present system.

Figure 17 is an isometric view of one embodiment of the present system.

Figure 18 is an isometric view of one embodiment of the present system.

Figure 19 is an isometric view of one embodiment of the present system.

Figure 20 is an isometric view of one embodiment of the present system.

Figure 21 is an isometric view of one embodiment of the present system.

Figure 22 is an isometric view of one embodiment of the present system.

Figure 23 is an isometric view of one embodiment of the present system.

Figure 24 is an isometric view of one embodiment of the present system.

Figure 25 is an isometric view of one embodiment of the present system.

Figure 26 is an organizational chart depicting typical applications of a modular communication system.

Figure 27 is a diagram of one embodiment of the present system with various modes of operation.

Figure 28 is an isometric view of a computer incorporating one embodiment of the present system.

Figure 29 is diagram depicting representative applications of a modular communication system.

Figure 30 schematically illustrates a residential garage door opener.

Figure 31 illustrates a block diagram of one embodiment of the present system.

Figure 32 illustrates one embodiment of a transceiver in accordance with one embodiment of the present system.

Figure 33 illustrates one embodiment of a transceiver in accordance with one embodiment of the present system.

Figure 34 illustrates one embodiment of a power supply in accordance with one embodiment of the present system.

Figure 35 illustrates one embodiment of a processor in accordance with one embodiment of the present system.

Figure 36 illustrates one embodiment of programming in accordance with one embodiment of the present system.

Figure 37 illustrates one embodiment of a method in accordance with one embodiment of the present system.

Detailed Description

This detailed description provides a number of different embodiments of the present system. The embodiments provided herein are not intended in an exclusive or limited sense, and variations may exist in organization, dimension, hardware, software, mechanical design and configuration without departing from the claimed invention, the scope of which is provided by the attached claims and equivalents thereof.

An embodiment of present system 100 is depicted in Figure 1 and includes module 200, long distance communication ("LD comm") module 250, communication and monitor service facility ("facility") 300, and personal data unit ("PDU") 400. Module 200 is in wireless communication with LD comm module 250 via link 215. LD comm module 250 is also in wireless communication with facility 300 via link 210 and in wireless communication with PDU 400 via link 225. Facility 300 is in communication with PDU 400 via link 215. In addition, module 200 is in wireless communication with PDU 400 via link 220 via link 220.

The operation of module 200, in one embodiment, is as follows. Module 200, in response to a sensed or detected condition, generates and wirelessly transmits digital data. The condition may include an event. The digital data may correspond to the magnitude of the condition or it may indicate that the event, or

condition, occurred. Other parameters or values of digital data are also possible. The digital data transmitted by module 200 is an omnidirectional broadcast signal. In the embodiment shown in Figure 1, the signal is communicated to LD comm module 250 by wireless link 205. LD comm module 250, in turn receives the digital data, or signal, and retransmits the signal on a long range communication channel. The long range communication channel may be an omnidirectional radio broadcast, a wired network or any other type of long range communication channel. In the embodiment shown, LD comm module 250 retransmits, or rebroadcasts the signal to facility 300 via wireless radio link 210. In other embodiments, the signal is rebroadcast via a land line, a satellite link, or a combination of links and such examples are exemplary of all links contemplated herein. Figure 1 also depicts LD comm module 250 in communication with PDU 400 via link 225. LD comm module 250, and thus, link 225, may communicate using a two-way pager network, in which case, PDU 400 is a two-way pager. Alternatively, PDU 400 receives communication from facility 300 using link 215.

Having received the digital data transmitted by module 200, PDU 400 displays or renders the information in a manner useful to a person carrying PDU 400. In one embodiment, PDU 400 provides an audible signal to a user. In one embodiment, PDU 400 generates and displays graphical or textual information for the benefit of a user. In one embodiment, PDU 400 generates a tactile signal.

One embodiment of the present system allows a user carrying PDU 400 to interact with module 200 using wireless links 205, 220, or 215. Additional features and functionality of system 100 are described below.

Figure 2A, 2B, 2C and 2D provide additional view of embodiments of module 200. As shown in the figures, module 200 includes two or more components. In Figure 2A, module 200 includes device 140A coupled to transceiver 150. Transceiver 150 includes a receiver and a transmitter to enable wireless communication with device 140A. In one embodiment, device 140A generates a signal that is coupled to transceiver 150. In one embodiment, device 140A responds to signals generated by transceiver 150.

Figure 2B depicts module 200 having transceiver 150 coupled to sensor 140B. In one embodiment, sensor 140B includes a security sensor such as a motion detector, a door position sensor, or a video camera. Sensor 140B, in one embodiment, includes an environmental sensor such as a temperature probe or gas detector. Sensor 140B may be an event detection sensor or parameter detection sensor. An event may include such discrete events as unauthorized intrusion, power failure, or fire. Parameters may relate to levels of gases or fluids, temperature, rate of change of temperature or any other measurable value. Examples of sensors include a video camera, a security system door or window contact, a gas detector (such as carbon monoxide), smoke detector, or audio microphone.

In Figure 2C, module 200 includes actuator 140C coupled to transceiver 150. Actuator 140C, in one embodiment, includes a solenoid actuator. Actuator 140C may include an operable component such as a transducer or other type of electromechanical device. An actuator may include a deadbolt or solenoid-type device, actuation of which results in a mechanical change in another apparatus. A transducer may include a siren, bell or other sounding device. Other types of actuators are also comprehended, including a sounding device or a relay. In Figure 2D, module 200 includes transceiver 150 coupled to sensor and actuator 140D. Sensor and actuator 140D, in one embodiment, includes a combination of a sensor and an actuator, as herein described. In the embodiment shown, transceiver 150 communicates with both elements of sensor and actuator 140D. In other words, transceiver 150 receives and transmits sensed information as well as operating an actuator.

Transceiver 150 of module 200, in one embodiment, is a wireless transceiver utilizing BLUETOOTH® communication technology. BLUETOOTH® is a trademark registered by Telefonaktiebolaget LM Ericsson of Stockholm, Sweden and refers to short range communication technology developed by an industry consortium known as the BLUETOOTH® Special Interest Group. BLUETOOTH® operates at a frequency of approximately 2.45GHz, utilizes a frequency hopping (on a plurality of frequencies), spread spectrum scheme, and provides a digital data transfer rate of approximately

1Mb/second. In one embodiment, the present system includes a transceiver in compliance with BLUETOOTH® technical specification version 1.0, herein incorporated by reference. In one embodiment, the present system includes a transceiver in compliance with standards established, or anticipated to be established, by the Institute of Electrical and Electronics Engineers, Inc., (IEEE). The IEEE 802.15 WPAN standard is anticipated to include the technology developed by the BLUETOOTH® Special Interest Group. WPAN refers to Wireless Personal Area Networks. The IEEE 802.15 WPAN standard is expected to define a standard for wireless communications within a personal operating space (POS) which encircles a person. In one embodiment, the transceiver is a wireless, bidirectional, transceiver suitable for short range, omnidirectional communication that allows ad hoc networking of multiple transceivers for purposes of extending the effective range of communication. Ad hoc networking refers to the ability of one transceiver to automatically detect and establish a digital communication link with another transceiver. The resulting network, known as a piconet, enables each transceiver to exchange digital data with the other transceiver. According to one embodiment, BLUETOOTH® involves a wireless transceiver transmitting a digital signal and periodically monitoring a radio frequency for an incoming digital message encoded in a network protocol. The transceiver communicates digital data in the network protocol upon receiving an incoming digital message. Referring again to the figure, the wireless transceiver enables remote communication with the sensor or actuator of module 200.

In general, the effective communication range of BLUETOOTH® is relatively short, often characterized with a maximum range of approximately 10 meters. The short range capabilities of BLUETOOTH® are suitable for premises-based applications, such as data exchange within a range roughly equal to the lineal boundaries of a typical property, or premises. However, communication can be extended beyond this range by a number of different methods.

Figure 3A depicts a method for extending the range of a BLUETOOTH® device involving a long distance communication module, LD comm module 250.

In the figure, module 200 transmits a BLUETOOTH® signal, depicted as link 205, to LD comm module 250. In one embodiment, PDU 400 communicates with a wireless link 225 to LD comm module 250. In one embodiment, link 225 may include a BLUETOOTH® connection, a cellular telephone network, a narrow band personal communication systems ("PCS") network, a CELLEMETRY network, a narrow band trunk radio network or other type of bidirectional wireless communication link. Examples of PCS technology includes Code-Division Multiple Access (CDMA by Qualcomm Inc.), ReFLEX (by Motorola), Time Division Multiple Access (TDMA), Global Systems for Mobile communications (GSM) or others. LD comm module 250 serves a relay function to extend the range of communications for module 200 or to extend the range of communications for PDU 400.

Figure 3B depicts LD comm module 250 coupled by link 210 to radio frequency (RF) tower 300A. RF tower 300A may provide frequency modulation (FM) transmission, satellite transmission capabilities, or other wireless link capabilities. In Figure 3C, LD comm module 250 is coupled by link 210 to network 300B. Network 300B may include wired telephone service, such as plain old telephone service ("POTS") or public switched telephone network ("PSTN"), fibre communication network, or other such network. In Figure 3D, LD comm module 250 is coupled to both RF tower 300A, via link 210A, and network 300B, via link 210B. Other types of networks are also contemplated.

Figure 4 depicts various communication linkages possible using LD comm module 250. Link 225A represents a two-way pager network communicating with PDU 400, depicted herein as a pager device. Link 225B represents a cellular network communicating with PDU 400, depicted herein as a cellular telephone. Link 210C represents a connection to modem 300C. Modem 300C may include a dial-up modem, an asynchronous digital subscriber line ("ADSL") modem, an integrated services digital network ("ISDN") modem or other type of modem. Link 210D represents a telephone communication network and includes telephone 300D. Link 210E represents a network connection depicted as network 300E. It will be appreciated that in Figure 4,

numerous communications linkages are depicted and in any one embodiment, one or more of the various communication linkages depicted may be utilized.

Alternative means of communicating over long distance are also contemplated. In one embodiment, the long distance network may include a cellular telephone network. A user with a cellular telephone, or other cellular device, is then able to communicate with the BLUETOOTH® device as though the user was local. The long distance network may include communications using a control channel. One such example is CELLEMETRY®. CELLEMETRY® is a registered trademark of Cellemetry LLC of Atlanta, Georgia, USA, and enables digital communications over a cellular telephone control channel. Other examples of communication technology are also contemplated, including MicroBurst™ technology (MicroBurst™ is a trademark of Aeris.net, Inc.) or short message service (SMS). In one embodiment, the long distance network may include a pager network. In one embodiment, the pager network is a two-way pager network enabling bidirectional communication between a BLUETOOTH®-enabled sensor, or device, and a user controlled pager. In one embodiment, the long distance network includes a narrow band Personal Communication System network. In one embodiment, the long distance network may include a telephone network. The telephone network may include communicating using an intranet or the Internet. Coupling to such a network may be accomplished, for example, using a variety of connections, including a leased line connection, such as a T-1, an ISDN, a DSL line, or other high speed broadband connection, or it may entail a dial-up connection using a modem. In one embodiment, the long distance network may include a radio frequency or satellite communication network. In addition, one or more of the aforementioned networks may be combined to achieve desired results.

The present system also contemplates various method of control. One example of control is known as dual-tone multi-frequency (DTMF) or touch-tone control. Another example is voice-actuated control wherein the system is responsive to spoken words. Other examples, or combinations, are also contemplated. For example, a system may transmit in one direction using SMS and yet receive communications in another direction using Microburst.

The BLUETOOTH® standard facilitates connectivity, and thus, range extension by coupling a plurality of BLUETOOTH®-enabled devices together. Figure 5 depicts the interconnectivity of several BLUETOOTH®-enabled devices. In this method, a wireless network is established that enables one BLUETOOTH® device to communicate with a second BLUETOOTH® device, effectively extending the range of the first device. The second device serves as a repeater, or relay, and receives and retransmits the BLUETOOTH® signal. By this method, a plurality of BLUETOOTH® devices can be daisy-chained together to achieve a desired range. For example, a single BLUETOOTH® transceiver is often described as having a short range, typically 10 meters (and up to 100 meters), and by combining a plurality of transceivers in a network, the range can be extended. Figure 5 portrays a system having modules 200A, 200B and 200C and LD comm module 250 and PDU 400. In the embodiment shown, modules 200A, 200B and 200C and LD comm module 250 are BLUETOOTH®-enabled, and thus links 202A, 202B and 202C as well as 205 are BLUETOOTH®-communication links. In one embodiment, PDU 400 is also BLUETOOTH®-enabled and thus, link 225 is a BLUETOOTH® communication link as well. In one embodiment, PDU 400 and LD comm module 250 communicate using a long range bidirectional wireless communication network.

An example of the operation of system 100 follows in which module 200A includes a motion detector sensor coupled to a transceiver. Motion detected by the sensor of module 200A is digitally encoded and transmitted by a BLUETOOTH® communication channel. In the embodiment shown, module 200C is positioned within the broadcast range of module 200A, and LD comm module 250 is positioned beyond the range of module 200A. In this case, module 200C receives the signal from module 200A and subsequently relays the digital signal to LD comm module 250. LD comm module 250, in turn, relays the digital signal, using long distance network represented herein by link 225, to PDU 400. The foregoing example describes an embodiment wherein, for example, module 200A is a first motion detector positioned at a front entry door of a residence, module 200B includes a second motion detector positioned at a

rear entry door, module 200C includes a smoke detector positioned in a central hallway, LD comm module 250 is coupled to a twisted-pair telephone network and positioned in the basement, and PDU 400 is a two-way pager device carried by a user at a remote location. In this example, the user can add modules and LD comm modules without regard for the connectivity or overall system design. The self-awareness feature and networking attributes of the BLUETOOTH® technology enable simplified system development and automatically provide range extension for communication linkages.

PDU 400 is a portable communication device operable for communicating digital data and having means for receiving data on a wireless link, displaying or signaling received or generated data, as well as receiving a user controlled input and transmitting data corresponding to the user controlled input. In one embodiment, PDU 400A is a two-way pager (Figure 6A). In one embodiment, PDA 400B is a cellular telephone (Figure 6B). In one embodiment, PDA 400C is a personal data (or digital) assistant (Figure 6C) and is commonly referred to as a PDA. Suitable PDAs include those marketed as PalmVII by Palm Computing of Santa Clara, California, USA. In one embodiment, PDA 400D is a personal communication device (Figure 6D). PDU 400 may also be a portable computer, such as a laptop or palmtop computer (not shown). Upon reading and understanding this description, one of ordinary skill in the art will recognize that PDU 400 includes a processor suitable for managing the transmission and communication functions of the present system.

It will be appreciated by one of ordinary skill in the art that, in one embodiment, one or more PDU 400 devices may be employed in a single installation. Furthermore, suitable encoding of the communication signal will enable custom notification wherein a first group of one or more PDU 400 devices receives and communicates notification for predetermined events sensed by module 200 while a second group of one or more PDU 400 devices does not communicate notification to a user.

One embodiment of present system 100 is shown in Figure 7 which depicts entry door 260 of a residence. Entry door 260, is equipped with lock 275, handle 280 and module 200D mounted on the exterior of the residence and

proximate to entry door 260. Also shown in Figure 9 is entry light 265 for illuminating the entry area, including entry mat 285. In one embodiment, module 200 is in wireless communication with other devices, or PDU 400B, shown in the figure as cellular telephone, via link 220A, and PDU 400A, shown in the figure as a two-way pager, via link 220B. Exterior module 200D is also in wireless communication with base 250A. As depicted herein, base 250 includes LD comm module as well as user operable controls and display to enable programming and operation of system 100. In one embodiment, the wireless communication between module 200D and base 250A includes BLUETOOTH® communication technology. As previously described, module 200D, in one embodiment, is in wireless communication with PDU 400B, via link 220B, base 250A, via link 205, or PDU 400A, via link 220A.

In operation, a caller at entry door 260 can initiate communication with a user via a PDU. For example, in one embodiment, a caller arriving at locked door 260 can operate module 200D in much the same way as a doorbell, that is, by activating a prominent and conspicuous button. Module 200D then encodes and communicates a digital message for transmission to PDU 400. The digital message

may be communicated directly from module 200 to PDU 400B, for example, either directly (via link 220B), or indirectly, via LD comm module 250A. In one embodiment, the communication to, and from, module 200D involves a BLUETOOTH® channel. In this example, the user receives notification of the presence of the caller by means of PDU 400B. The user, and PDU 400B, may be located inside the residence, in which case a direct connection using link 220B may be possible. Alternatively, the user, and PDU 400B, may be located outside of the residence, in which case, an indirect link, including link 205 coupling the LD comm module 250A may be employed. In either case, the caller is unlikely to perceive the actual location of the user. Furthermore, by way of operating the controls or a numeric keypad on PDU 400B, the user may control the operation of entry light 265 or lock 275 and thereby grant access to the premises for the caller.

Figure 8 depicts a top view of one embodiment of the present system as installed at an entry door 260 of a residence. Door 260 is positioned in door frame 258 and includes exterior door knob 282 and interior door knob 284. The installation also includes exterior module 200D and interior module 200E. Exterior module 200D includes video camera 370, exterior keypad 305 and an intercom. Other sensors or detector modules are also contemplated as part of exterior module 200D, such as, for example, a doorbell. Interior module 200E includes interior motion detector/video camera 310, light switch 315 and keypad/control 320. Door 260 is also fitted with deadbolt lock 275 (or door bolt) and door contact 290. Floor mat 285 is shown for purposes of clarity.

In one embodiment, a caller standing in the vicinity of entry mat 285 signals their arrival by actuating a doorbell button, incorporated in exterior module 200D, in the customary manner. In one embodiment, arrival of the caller is detected by video camera 370. In response to actuation of the button, or detection by camera 370, exterior module 200D transmits a wireless signal. In one embodiment, the wireless signal is transmitted using a BLUETOOTH® communication channel. The signal is communicated to PDU 400 (not shown in this figure). A user, equipped with PDU 400 can respond in a number of ways. In one embodiment, the user may elect to open an audio communication channel by entering a command using PDU 400. Upon opening an audio communication channel, the caller and user can engage in bidirectional verbal discourse. In one embodiment, the user may opt to receive a graphical image of the caller using PDU 400. Entry of an appropriate command causes exterior module 200D to capture an image using exterior video camera 370 and transmit said image to PDU 400. The graphical image may include a still image or real-time video images. In one embodiment, a user at a remote locations can enter a command at PDU 400 to cause deadbolt 275 to engage or disengage. In one embodiment, one or more of the aforementioned operations are available using PDU 400.

In one embodiment, the aforementioned communications with exterior module 200D can be performed using interior module 200E in lieu of PDU 400. Both exterior module 200D and interior module 200E communicate using a BLUETOOTH® communication channel and thus are able to engage in direct

communication when mounted sufficiently close to each other. Also, like PDU 400, interior module 200E can control the operation of the exterior module 200D as well as the deadbolt lock 275 and camera 370.

One embodiment of exterior module 200D of the present system, having doorbell button 325 and keypad 305 is depicted in Figure 9. Exterior module 200D includes alpha-numeric keypad 305 for receiving coded information. For example, in one embodiment, an authorized callers can enter a predetermined code sequence to cause deadbolt lock 275 (Figure 8) to engage or disengage. Also, a user can enter a code sequence in PDU 400, for wireless transmission to exterior module 200D, and operate deadbolt lock 275. In one embodiment, module 200D includes a card reader for receipt of identification information from a caller. The card reader may include a smart-card reader or a magnetic card reader.

Wireless transmissions with exterior module 200D are communicated using transceiver 150D. In one embodiment, a code sequence entered using alphanumeric keypad 305 or PDU 400 can operate entry light 265 (Figure 7) or other devices or appliances. Exterior module 200D also includes video camera 370. In one embodiment, images captured using camera 370 can be transmitted to other devices, including PDU 400 or interior module 200E (Figure 8) or base 250A (Figure 7). In one embodiment, exterior module 200D includes intercom 330 for conducting intercom, or audio communication functions. In one embodiment, intercom 330 includes an audio transducer. In one embodiment, intercom 330 includes a speaker and a microphone.

In one embodiment, exterior module 200D is of a size and configuration to fit within scheduled electric boxes or fixtures. In one embodiment, the power to operate exterior module 200D is derived from the metered electric service already available at the electric box in which module 200D is mounted. In one embodiment, module 200D is battery operated.

Figure 10 depicts one embodiment of interior module 200E having intercom 335, push-to-talk ("PTT") switch 320, interior motion detector/video camera 310, transceiver 150E and light switch 315. Intercom 335, in conjunction with PTT switch 320, enables bidirectional wireless communication.

Intercom 335 can be adapted to communicate with exterior module 200D, PDU 400, base 250A (Figure 7) or other compatible device. Similarly, detected motion or video images captured by camera 310 can be communicated with PDU 400, base 250A, or other compatible device. In one embodiment, interior module 200E is of a size and configuration to fit within scheduled electric boxes or fixtures. In one embodiment, power for interior module 200E is derived from the metered electric service already available at the electric box in which module 200E is mounted. In one embodiment, power is supplied by a battery. In one embodiment, switch 315 operates a household light, power outlet or other appliance.

In one embodiment, the present system can arm or disarm a security system as a function of an image captured by video camera 370 (Figure 8), data received from deadbolt lock 275, or door contact 290. For example, in one embodiment, when door 260 is closed, as determined by contact 290, or the deadbolt 275 is engaged, and the image captured by camera 370 corresponds to an authorized user or caller, then transceiver 150D (Figure 9) sends a signal, on a wireless link, to other modular security system components (such as base 250A, Figure 7), causing perimeter security system components to be armed and interior security system components to be disarmed. Alternatively, when the sensors associated with module 200D, or 200E, indicate the absence of an authorized caller or user, then in one embodiment, both the interior and exterior security system sensors are activated. In one embodiment, deadbolt 275 includes a plunger-type switch to sense the bolt position. Modular security system components are described in a subsequent section of this document.

Figure 11 depicts one embodiment of the present system. In the embodiment shown, the system includes alarm clock and display 340. Devices other than an alarm clock are also contemplated, as, for example, a cordless telephone with display. The alarm clock of Figure 11 is typically positioned in a sleeping room and, thus, is convenient for managing and controlling home devices and appliances, as well as providing easy communication with other modules. Module 200F includes display 340 and user operable control buttons 342, 344 and 346. Module 200F is operable as an ordinary alarm clock having a

digital display of the time appearing on display 340. Control buttons 342, 344 and 346 are operable for setting the current time as well as an alarm time. Module 200F is powered by metered service, internal battery, or both. Module 200F includes a wireless transceiver for control of, or communication with, other wireless modules. In one embodiment, the wireless transceiver operates using BLUETOOTH® communication technology. In Figure 11, module 200F is shown in communication with coffee maker 200G via wireless link 202G, television 200H via wireless link 202H, and furnace 200K, via wireless link 202K and air conditioner 200J via wireless link 202J. In one embodiment, coffee maker 200G, television 200H, furnace 200K and air conditioner 200J are equipped with wireless communication modules. In one embodiment, coffee maker 200G, television 200H, furnace 200K and air conditioner 200J are coupled to a suitably equipped outlet, as described subsequently with regard to Figure 18 or other interface module incorporating the present system.

Module 200F includes suitable programming for the control of such modules. In one embodiment, a user can operate control buttons 342, 344 and 346 to cause module 200F to display, using display 340, a menu of control options concerning each of the various modules. In one embodiment, operation of button 342 enables selection of a desired output device for control by module 200F. For example, the user can select to control coffee maker 200G and furnace 200K by manipulation of control 342. In one embodiment, a coffee maker menu appears in display 340. Again, using buttons, 342, 344 and 346 a user can program the system to cause the coffee maker to perform desired functions according to a programmed schedule. In one embodiment, second button 344 enables a user to select a time for control or operation of the desired output. For example, a user can select to operate a selected output device according to an absolute time. In other words, a user can choose to brew coffee using coffee maker 200G every day at 9:00 AM or other desired time. Button 344 also allows a user to select a relative time for operating a selected output device. For example, a user can configure module 200F to cause the furnace to seek a temperature of 68 degrees Fahrenheit every day at 30 minutes prior to the wake-up alarm setting. As another example, a user can configure the system to

begin brewing coffee thirty minutes prior to sounding the wake-up alarm, and also shut off the power to the coffee warming element 120 minutes after sounding the wake-up alarm. Button 344 also enables a user to select a default, or pre-programmed time for operating a selected appliance. For example, the manufacturer may have configured module 200F to operate a selected output device daily at 8:30 AM unless otherwise provided. Button 346 is operable for setting the clock and for setting an alarm function.

In one embodiment, a user can arm or disarm selected elements of a security system using module 200F. In one embodiment, the user can interact with a caller at an entry door, via exterior module 200D. Upon reading and understanding this description, one of skill in the art will recognize that functions available using PDU 400 are also available using module 200F.

Figure 12 depicts a base station with LD comm module 250A in one embodiment of the present system. In one embodiment, base 250A is in communication with communication network 300 via wireless link 210. Communication network 300 may include, but is not limited to, a cellular telephone network, a CELLEMETRY® network, a two-way pager network, a public switched telephone network or a radio frequency network. Communication network 300 enables long range communication.

Figure 13 depicts one embodiment of the present system. In one embodiment, module 200L is responsive to heat. In one embodiment, module 200L is responsive to smoke. In one embodiment, module 200L is battery powered, and in one embodiment, module 200L is powered by metered electric service. Module 200L is coupled via a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 14 depicts one embodiment of the present system. In one embodiment, modules 200M are responsive to glass breakage of glass panes in window 500. In one embodiment, modules 200M are battery powered, and in one embodiment, modules 200M are powered by metered electric service. Wireless links couple modules 200M to other wireless devices or modules

within the system. In one embodiment, the wireless links comprise BLUETOOTH® communication technology.

Figure 15 depicts one embodiment of the present system. In one embodiment, module 200N includes a video camera mounted to a wall. In one embodiment, module 200N captures and transmits video images and may be battery powered or powered by metered electric service. Module 200N is coupled via wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 16 depicts one embodiment of the present system installed at entry door 510. In one embodiment, module 200Q includes a magnetic contact to detect the position of door 510 relative to door frame 505. Module 200Q is battery powered or powered by metered electric service. Module 200Q is coupled by wireless link to other wireless devices or modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology. Figure 16 also depicts module 200R including deadbolt lock with bolt receiver. In one embodiment, module 200R comprises a sensor to detect the position of the deadbolt lock. Signals generated by module 200R are communicated via wireless link to other wireless devices or modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 17 depicts one embodiment of the present system. In Figure 17, module 200S includes a motion sensor mounted on a wall surface and detects motion of people and animals within the room. In one embodiment, module 200S may be battery powered or powered by metered electric service. In one embodiment, module 200S may include a passive infrared motion sensor. Module 200S is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 18 depicts one embodiment of the present system. In Figure 18, wall mounted duplex outlet 520 is coupled via wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises

BLUETOOTH® communication technology. In response to other wireless modules within the system, including PDU 400, module 200S alternatively powers or unpowers appliances and devices that are connected to outlet 520. In one embodiment, power for the operation of module 200S is derived from the line current supplying outlet 520.

Figure 19 depicts one embodiment of the present system. In Figure 19, module 200U includes a siren, or other sounding device, for sounding an alarm. In one embodiment, module 200U may be battery powered or powered by metered electric service. Module 200U is coupled by wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 20 depicts one embodiment of the present system. In Figure 20, module 200V includes a doorbell for signaling callers. In one embodiment, module 200V is battery powered or powered by metered electric service. Module 200V communicates by wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 21 depicts one embodiment of the present system. In Figure 21, module 200X includes a monitor for receiving and transmitting audio. In one embodiment, module 200X includes audio transducer 530 and control button 535. Activation of control button 535, in one embodiment, operates to send an emergency assistance request to PDU 400 or other module. Module 200X is operable as a room or baby monitor. In one embodiment, module 200X is operable as part of a bidirectional intercom system. In one embodiment, module 200X may be battery powered or powered by metered electric service. Module 200X is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 22 depicts one embodiment of the present system. In Figure 22, module 200Y includes a monitor for receiving and transmitting audio and transmitting video sensed by optical sensor 540. In one embodiment, module 200Y includes audio transducer 530, control button 535, and optical sensor 540.

Module 200Y is operable as a room or baby monitor. In one embodiment, module 200Y is operable as a part of a bidirectional audiovisual intercom system. In one embodiment, module 200Y may be battery powered or powered by metered electric service. Module 200Y is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 23 depicts one embodiment of the present system. In Figure 23, module 200Z includes a building environmental control device. In one embodiment, module 200Z includes a thermostat. In one embodiment, module 200Z includes a humidistat. In one embodiment, module 200Z includes programming to allow a user to enter, or select, a schedule for operating and controlling heating, ventilation or air conditioning ("H/VAC") equipment. Module 200Z includes visual display 545 and user operable control 550. In one embodiment, module 200Z may be battery powered, powered by metered electric service, or powered by a system voltage used to operate the heating, ventilating, or air conditioning equipment. In one embodiment, the system voltage is a low voltage 24 VAC service. Module 200Z is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology. In operation, one embodiment enables a user to control the operation of heating, ventilating, or air conditioning equipment from PDU 400. In addition, one embodiment provides that measured or sensed data is transmitted to PDU 400 for the benefit of a user. In addition, one embodiment having control 550, enables a user to program and determine the operation the H/VAC equipment. Other functions are also contemplated, including programming of the H/VAC system operation, monitoring the H/VAC system integrity or troubleshooting operation of various system components.

Figure 24 depicts one embodiment of the present system. In Figure 24, module 200AA is an atmospheric condition monitoring device. In one embodiment, module 200AA is a thermometer. In one embodiment, module 200AA is a barometric pressure monitor. In one embodiment, module 200AA includes a first display 555 and a second display 560 for monitoring outdoor and

indoor air temperature, respectively. Data generated by module 200AA may also be communicated to other devices, including, for example, PDU 400 for display to the user or to environmental or H/VAC system control equipment such as that depicted in Figure 23. In one embodiment, module 200AA may be battery powered, system (or appliance) power or powered by metered electric service. Module 200AA is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 25 depicts one embodiment of the present system. In Figure 25, module 200AB is another embodiment of an atmospheric condition monitoring device. In one embodiment, module 200AB includes a temperature probe or other remote sensor. In one embodiment, module 200AB operates in conjunction with, and communicates with the module of Figure 24 or Figure 23. Data generated by module 200AB may also be communicated to other devices, including, for example, PDU 400 for display to the user or to environmental or H/VAC system control equipment. In one embodiment, module 200AB may be battery powered, solar powered or powered by metered electric service. Module 200AB is coupled by a wireless link to other wireless modules within the system. In one embodiment, the wireless link comprises BLUETOOTH® communication technology.

Figure 26 depicts an organizational diagram for one embodiment of a module system as herein described. Modular system 100 includes a security system 565 and an environmental controls and monitoring system 570. Security system 565 may also provide safety features.

In the embodiment shown, security system 565 includes detection system 575 and notification system 580. Other systems are also contemplated, including for example, configuration, programming and diagnostic or troubleshooting systems. Detection system 575 include components such as a motion detector (including a passive Infrared "PIR" sensor), a door or window contact or a video camera. Notification system 580 includes components such as a wireless communication link, a PDU 400 device, a visual display, or an alarm clock-based control such as that depicted in Figure 11. Safety system components may

include an emergency call button module or a portable personal locator module driven by a global positioning satellite system (GPS) or other situational sensor.

In the embodiment shown, environmental controls and monitoring system 570 includes sensors and detectors 585, reporting 590 and actuators and transducers 595. Other systems are also contemplated, including for example, configuration, programming and diagnostic or troubleshooting systems. Sensors and detectors 585 include components such as a temperature probe, a position sensor (for determining an actuator position) or a fluid or gas detector. Reporting 590 includes components such as a wireless communication link, a PDU 400 device, a visual display, or an alarm clock-based control such as that depicted in Figure 11. Actuators and transducers 595 may include components such as a thermostat control, a sounding device such as a siren and others.

Figure 27 depicts one embodiment of the present system configured for building security and environmental control. In Figure 27, PDU 400 is wirelessly coupled to a plurality of sensor or control modules. PDU 400 is operable to wirelessly manage the system from a short range as well as a long range. In Figure 27, the system comprises perimeter modules 620A, 620B and 620C. In one embodiment, modules 620A, 620B and 620C may include a door contact, a video camera, a glass breakage detector, or other types of modules configured to detect a security breach occurring at the perimeter of a building or premises. Figure 27 also depicts a plurality of interior sensor modules, designated 625A, 625B and 625C. In one embodiment, modules 625A, 625B and 625C may include a motion detector, a video camera, a proximity detector, an intercom or monitor or other types of sensors configured to detect a security breach occurring in the interior of a building or premises. Figure 27 also depicts a plurality of building control or sensor modules, designated 630A and 630B. In one embodiment, modules 630A and 630B may include a thermostat, a humidistat, an electric window blind, an air conditioner control, a door lock control or other types of controls or sensors configured to manage a building or premises. Figure 27 also depicts a plurality of power control modules, designated 635A and 635B. In one embodiment, modules 635A and 635B may include power outlets coupled to such devices as a coffee maker, a television or

VCR, a floor lamp or other types of appliances or devices. Figure 27 also depicts a plurality of reporting sensor modules, designated 640A, 640B and 640C. In one embodiment, modules 640A, 640B and 640C may include a smoke detector, a freeze detector, a carbon monoxide detector, an interior/exterior temperature detector, or other types of sensors configured to facilitate management of a building or premises. In one embodiment, a reporting sensor module may include a device configured to monitor salt levels in a water softener. Such a sensor can communicate wirelessly with PDU 400 to report the need for servicing of a water softener. In one embodiment, a reporting sensor may include a device configured to monitor the status or operation of an air filter in a heating or ventilation system. Such a sensor can communicate wirelessly with PDU 400 to report the need for servicing of the filter. In one embodiment, a reporting sensor may include a module configured to monitor the condition of a rain gutter or eave trough. Such a module can communicate wirelessly with PDU 400 to report the need for servicing of a rain gutter or eave trough. Other such modules are also contemplated by the present description.

Figure 28 depicts another embodiment of the present system. Figure 28 depicts a computer 700 coupled to keyboard or input device 705, and display monitor 710. Computer 700 includes a processor, memory and preferably includes one or more disk drives. Computer 700 also includes a module having a wireless transceiver for communication with other modules or PDU 400 devices. In one embodiment, the wireless communication of data is conducted using BLUETOOTH® communication technology. Programming operable on computer 700 enables management of the sensors, devices, controls or modules of the present system. In one embodiment, menu-driven programming enables a user to configure the system to report predetermined conditions to a local or remote PDU 400 or a remote monitoring facility. In one embodiment, the system reports to an e-mail address. In one embodiment, the system reports to an Internet address. In one embodiment, suitable programming enables a user to configure the system to periodically report predetermined conditions needing servicing. For example, periodic cleaning of a gutter or eave trough can be

enunciated to a portable PDU 400 configured to wirelessly communicate with the present system.

Figure 29 depicts control program 720 and representative modules controllable using one embodiment of the present system. For example, module 725 may include an alarm clock module which can be wirelessly managed and controlled using program 720 operating on computer 700. As another example module 730 may include a furnace filter sensor that can be wirelessly monitored using program 720 operating on computer 700. Other modules are also depicted, enumerated 735, 740, 745 and 750, each of which may include any type of module herein disclosed, including, for example, sensors for managing the operation of a water softener, monitoring and managing exterior building maintenance, operating and maintaining a coffee maker, operating a television or entertainment center or operating a furnace. In one embodiment, the wireless communication of data is conducted using BLUETOOTH® communication technology.

In the embodiment of Figure 29, LD comm module 755 is shown coupled to control program 720. In operation, LD comm module can be configured by program 720 to communicate with a predetermined network selected from a plurality of networks. As another example, LD comm module con be configured to communicate with a predetermined PDU 400 using a preselected schedule for communicating. In other words, one example provides that for weekdays, LD comm module 755 communicates using a two-way pager network and directs all communications to a PDU 400 carried by a first person, and on weekends, LD comm module 755 is configured to communicate with a second person using a PDU 400 over a cellular telephone network. Other configurations and combinations are also contemplated. As another example, control program 720 may be configured to report H/VAC equipment status to a first PDU 400 and security system signals to a second PDU 400.

Figure 31 illustrates a block diagram of one embodiment of present system 10000. System 10000, illustrated by the dashed box, includes processor 12000, power supply 12500, transceiver 13000, programming 15000 and position sensor 15500. Processor 12000 is coupled to, and executes,

programming 15000. Processor 12000 is also coupled to elements labeled power 12500 and transceiver 13000.

In the figure, GDO 1000 represents a garage door opener which may include system 1000 as previously described relative to Figure 32. It will be appreciated that, for purposes of this description, the garage door opener 1000 is not included in the system. However, other embodiments of the system are also contemplated, one of which includes the garage door opener as part of the system.

Processor 12000 may include a microprocessor as well as memory to perform the programmed functions and to retain settings and configuration information. Processor 12000 may also include a driver circuit to provide an electrical signal at a level sufficient to operate the garage door opener. Processor 12000 may also include a circuit to receive electrical signals from electrical, or electromechanical sensors and monitors and to provide an electrical signal to drive an actuator.

Power supply 12500 represents a power supply system that provides electrical energy for system 10000. As described in a subsequent section, power supply 12500 may include a battery power supply and a line powered supply.

Programming 15000 may include the instructions and data to enable the processor to perform the functions of the present system. Among the programming functions in one embodiment are instructions for causing processor 12000 to actuate a particular control upon receiving a predetermined signal. For example, if a garage door position sensor indicates that the door is in a raised position and an obstruction in the path of the garage door travel is detected by an optical sensor, then a signal received by the processor requesting the door to be closed is met with programming requesting that the obstruction be cleared before the door will travel. Processor 12000 and programming 15000 may include logic gates, circuitry or software to accomplish the selected functions.

Transceiver 13000 represents a wireless receiver and transmitter able to communicate using both a long range communication protocol and a short range communication protocol. For example, in one embodiment, the transceiver

module includes two separate transceivers, namely, a long range transceiver 13500 for long range communications, such as that used with cellular telephone communications and second transceiver for communicating over a short range. A short range communication protocol, such as BLUETOOTH®, allows wireless communications over distances commonly thought of as premises-based. It will be further appreciated that with suitable repeaters, gateways, switches or networks, the effective range of communication of transceiver 13000 may be extended to any distance.

In one embodiment, transceiver 13000 communicates, using a short range protocol, with a second transceiver that communicates using a long range protocol. For example, transceiver 13000 may include a BLUETOOTH® transceiver and may communicate with a second transceiver. The second transceiver, in addition to having a BLUETOOTH® section, also interfaces with a long range communication network. For example, the second transceiver may include a BLUETOOTH® transceiver and a connector that interfaces with a public switched telephone network (PSTN), a cellular telephone network, a pager network or other network having a long range communication protocol.

According to one definition, and subject to the vagaries of radio design and environmental factors, short range may refer to systems designed primarily for use in and around a premises and thus, the range generally is below a mile. Short range communications may also be construed as point-to-point communications, examples of which include those compatible with protocols such as BLUETOOTH®, HomeRF™, and the IEEE 802.11 WAN standard (described subsequently). Long range, thus, may be construed as networked communications with a range in excess of short range communications. Examples of long range communication may include, Aeris MicroBurst cellular communication system, and various networked pager, cellular telephone or, in some cases, radio frequency communication systems.

In various embodiments, a user may communicate with system 10000 using a telephone coupled to the public switched telephone network (PSTN), a cellular telephone, a pager (either one way or two way), a personal

communication device (such as a personal digital assistant, PDA), a computer, or other wired or wireless communication device.

Position sensor 15500 is coupled to processor 12000. In various embodiments, sensor 15500 may include one or more magnetic switches, contact switches, optical devices or cameras. For example, in one embodiment, sensor 15500 includes a first magnetic switch to detect door 4000 in an open position and second magnetic switch to detect door 4000 in a closed position. Sensor 15500 may be connected to processor 12000 by a wired connector or by a wireless link. Sensor 15500 provides an electrical signal corresponding to the position of door 4000. The input to sensor 15500 may be derived from door 4000, trolley 2500, or other member that provides reliable information relative to the position of door 4000.

An embodiment of transceiver 13000 is illustrated in Figure 32. Transceiver 13000A is coupled to processor 13000 by link 132A. In the figure, transceiver 13000A is shown having compatibility with both a cellular telephone protocol 13500A and a BLUETOOTH® protocol 14000A. Other long range communication protocols may include, but are not limited to, cellular telephone protocols, one way or two-way pager protocols, and personal communication service (PCS) protocols. Examples include Time Division Multiple Access (TDMA), 3G, Aloha, Global System for Mobile Communications (GSM), Code-Division Multiple Access (CDMA), Short Message Service (SMS) and General Packet Radio Service (GPRS).

Personal Communications Service (PCS) describes a set of cellular technologies employing CDMA (also known as IS-95), GSM, or North American TDMA (also known as IS-136) air interfaces. PCS systems typically operate in the 1900 MHZ frequency range.

Time Division Multiple Access (TDMA) describes a digital wireless technology using time-division multiplexing (TDM) in which a radio frequency is time divided and slots are allocated to multiple calls. TDMA is used by the GSM digital cellular system.

A third specification, known as 3G, promulgated by the ITU (International Telecommunication Union, headquarters in Geneva, Switzerland)

represents a third generation of mobile communications technology with analog and digital PCS representing first and second generations. 3G is operative over wireless air interfaces such as GSM, TDMA, and CDMA. The new EDGE (Enhanced Data rates for Global Evolution) air interface has been developed specifically to meet the bandwidth needs of 3G.

Another protocol, known as Aloha, enables satellite and terrestrial radio transmissions.

Global System for Mobile Communications, GSM, is another digital cellular system and uses TDMA, thus allowing eight simultaneous calls on the same radio frequency.

Code-Division Multiple Access (CDMA) is a digital cellular technology that uses spread-spectrum techniques. CDMA does not assign a specific frequency to each user but rather every channel uses the full available spectrum and individual conversations are encoded with a pseudo-random digital sequence.

Another transmission protocol, Short Message Service (SMS) allows communications of short messages with a cellular telephone, fax machine and an IP address. Messages are generally limited to a length of 160 alpha-numeric characters.

General Packet Radio Service (GPRS) is another standard used for wireless communications and operates at transmission speeds far greater than GSM. GPRS can be used for communicating either small bursts of data, such as e-mail and Web browsing, or large volumes of data.

The short range communication protocol may include, but is not limited to, wireless protocols such as BLUETOOTH®, HomeRF™, wireless LAN (WLAN) or other personal wireless networking technology.

BLUETOOTH® is a trademark registered by Telefonaktiebolaget LM Ericsson of Stockholm, Sweden and refers to short range communication technology developed by an industry consortium known as the BLUETOOTH® Special Interest Group. BLUETOOTH® operates at a frequency of approximately 2.45 GHZ, utilizes a frequency hopping (on a plurality of frequencies) spread spectrum scheme, and provides a digital data transfer rate of

approximately 1Mb/second. In one embodiment, the present system includes a transceiver in compliance with BLUETOOTH® technical specification version 1.0, herein incorporated by reference. In one embodiment, the present system includes a transceiver in compliance with standards established, or anticipated to be established, by the Institute of Electrical and Electronics Engineers, Inc., (IEEE). The IEEE 802.15 WPAN standard is anticipated to include the technology developed by the BLUETOOTH® Special Interest Group. WPAN refers to Wireless Personal Area Networks. The IEEE 802.15 WPAN standard is expected to define a standard for wireless communications within a personal operating space (POS) which encircles a person. In one embodiment, the transceiver is a wireless, bidirectional, transceiver suitable for short range, omnidirectional communication that allows ad hoc networking of multiple transceivers for purposes of extending the effective range of communication. Ad hoc networking refers to the ability of one transceiver to automatically detect and establish a digital communication link with another transceiver. The resulting network, known as a piconet, enables each transceiver to exchange digital data with the other transceiver. According to one embodiment, BLUETOOTH® involves a wireless transceiver transmitting a digital signal and periodically monitoring a radio frequency for an incoming digital message encoded in a network protocol. The transceiver communicates digital data in the network protocol upon receiving an incoming digital message.

In general, the effective communication range of BLUETOOTH® is relatively short, sometimes characterized with a maximum range of approximately 10 to 100 meters. The short range capabilities of BLUETOOTH® are suitable for premises-based applications, such as data exchange within a range roughly equal to the lineal boundaries of a typical property, or premises.

Communication range can be extended beyond this range by a number of different methods. For example, the range may be extended by coupling a BLUETOOTH® connection with a cellular telephone network, a narrow band personal communication systems ("PCS") network, a CELLEMETRY network, a narrow band trunk radio network or other type of wireless communication link.

Examples of PCS technology includes Code-Division Multiple Access (CDMA by Qualcomm Inc.), ReFLEX (by Motorola), Time Division Multiple Access (TDMA), Global Systems for Mobile communications (GSM) or others.

A user with a cellular telephone, or other cellular device, is then able to communicate with the BLUETOOTH® device as though the user was local. The long distance network may include communications using a control channel. One such example is CELLEMETRY®. CELLEMETRY® is a registered trademark of Cellemetry LLC of Atlanta, Georgia, USA, and enables digital communications over a cellular telephone control channel. Other examples of communication technology are also contemplated, including MicroBurst™ technology (MicroBurst™ is a trademark of Aeris.net, Inc.) or short message service (SMS). In one embodiment, the long distance network may include a pager network. In one embodiment, the pager network is a two-way pager network enabling bidirectional communication between a BLUETOOTH®-enabled sensor, or device, and a user controlled pager. In one embodiment, the long distance network includes a narrow band Personal Communication System network. In one embodiment, the long distance network may include a telephone network. The telephone network may include communicating using an intranet or the Internet. Coupling to such a network may be accomplished, for example, using a variety of connections, including a leased line connection, such as a T-1, an ISDN, a DSL line, or other high speed broadband connection, or it may entail a dial-up connection using a modem. In one embodiment, the long distance network may include a radio frequency or satellite communication network. In addition, one or more of the aforementioned networks may be combined to achieve desired results.

Another short range communication protocol, known as HomeRF™, currently defined by specification 2.1, provides support for broadband wireless digital communications at a frequency of approximately 2.45 GHZ. HomeRF™ specification 2.1 is herein incorporated by reference.

Other long range and short range communication protocols are also contemplated and the foregoing examples are not to be construed as limitations but merely as examples.

Transceiver 13000 may be compatible with more than two communication protocols. For example, transceiver 13000 may be compatible with three protocols, such as a cellular telephone communication protocol, a two-way pager communication protocol, and BLUETOOTH® protocol. In such a case, a particular garage door opener may be operable using a cellular telephone, a two-way pager, or a device compatible with BLUETOOTH®. Furthermore, it will be appreciated that each of the aforementioned devices, namely a cellular telephone, a two-way pager, and a device compatible with BLUETOOTH®, may be combined in a single portable housing.

Transceiver 13000 may include circuitry to allow communications on more than one protocol. For example, position information may be received on a pager protocol and a user may transmit a command to operate the door opener using a cellular telephone protocol.

Figure 33 illustrates an embodiment of transceiver 13000B that is compatible with a pager protocol 13500B and a BLUETOOTH® protocol 14000B. Transceiver 13000B is coupled to processor 13000 by link 132B. Pager protocol 13500B may include one way or two way pager protocols. Examples of one way pager protocols include Post Office Code Standardisation Advisory Group (POCSAG), Swedish Format (MBS), the Radio Data System (RDS, by Swedish Telecommunications Administration) format and the European Radio Message System (ERMES, by European Telecommunications Standards Institute) format, Golay Format (by Motorola), NEC-D3 Format (by NEC America), Mark IV/V/VI Formats (Multitone Electronics), Hexadecimal Sequential Code (HSC), FLEX™ (Motorola) format, Advanced Paging Operations Code (APOC, by Philips Paging) and others. Examples of two way pager protocols include ReFLEX™ (Motorola) format, InFLEXion™ (Motorola) format, NexNet™ (Nexus Telecommunications Ltd. of Israel) format and others.

In one embodiment using a pager system, system 1000 provides a pager signal to indicate the position of the door or any other information relative to the garage or the door opener. Using a one way pager, the user may operate the door opener, or operate an actuator, using another communication channel, including for example, a cellular telephone or a personal communication device. Using a

two way pager, the user may operate the door opener, or operate an actuator, using the reply communication channel of the pager. The outbound signal (e.g., indicating the door position) may be transmitted to the pager on a predetermined schedule, or upon inquiry, or upon a change of position of the door (or actuator) at any time.

Figure 34 illustrates one embodiment of power supply 12500A. Battery power 12700 may include a dry cell, a gel cell, or other power supply. In addition, battery power 12700 may include rechargeable batteries. The recharging power may be supplied by line power 12800, solar power derived from sunlight, or other available means. Line power 12800 may include 110 volt metered electric service, 220 volt metered electric service, or other convenient electrical service. In one embodiment, door opener 1000 includes a plug-in power cord which couples to a nearby electrical outlet. In such a case, the battery power 12700 is received from line power 12800.

In the event of a power outage, or other interruption of the metered electric service, door opener 1000 may not be operable. However, battery power 12700 has sufficient capacity to continue powering processor 12000, transceiver 13000, and position sensor 15500. Battery power 12700 allows the user to continue to wirelessly receive information regarding the position of the door regardless of the status of line power 12800. In one embodiment, transceiver 13000 provides a wireless signal to the user to indicate that line power 12800 has been restored.

Figure 35 illustrates a variety of sensors, actuators, and transducers coupled to processor 12000. Driver circuits and receiver circuits may be employed between the sensors, actuators, and transducers to provide a signal level compatible with that of the processor. In various embodiments, one or more of the following sensors, actuators, and transducers may be included in system 10000. In one embodiment, system 10000 includes apparatus to provide a camera view of the door. The camera view may be derived from a video camera or still camera as part of system 10000 and the view may represent full motion video or still photos of the door or other operated equipment.

Auxiliary sensor 16000 may be coupled to processor 12000. Sensor 16500 represents an example of an auxiliary sensor coupled to a service door or other entry. The service door may provide access to the interior of the garage or it may provide access to other areas associated with the garage. For example, sensor 16500 may monitor the position of a gate at the driveway to the garage. Optical sensor 17000 may include any sensor relying on optical information to generate an electrical signal. For example, sensor 17000 may include a light source and photocell to detect hazards associated with operation of door 4000 or sensor 17000 may provide a signal to indicate if an interior or exterior garage light is illuminated. Sensor 17000 may also provide a signal to indicate if it is daytime or nighttime. Temperature sensor 17500 may include a thermal element to indicate a temperature present inside the garage or external to the garage. For example, sensor 17500 may indicate a freezing hazard or an overheating condition within the garage. Temperature sensor 17500 may also be coupled to door opener 1000 to indicate a dangerous overheating condition of opener 1000.

Door opener 1000 may be coupled to processor 12000. Door opener 1000 may include a system as described above relative to Figure 32.

Auxiliary sensor 18500 may be coupled to processor 12000 and may include electrical or mechanical actuators or controls other than opener 1000. For example, sensor 19000 indicates a courtesy light controller. Using the remote control of the present system, a user can control an interior or exterior courtesy light. Controlling the light may include adjusting the brightness or turning it on, off or flashing the light. As another example, HVAC actuator 20000 represents any or all elements of a heating, ventilation and air conditioning system. In particular, HVAC actuator 20000 may include a coupling to a mechanical actuator, thermostat, ventilation system or other control. Using the remote control of the present system, a user can control heating, ventilation, or air conditioning system. Sensor 17500 may operate in conjunction with HVAC actuator 20000. Service door operator 19500 indicates a power door actuator coupled to a service door, or other entry, providing access to the interior of the garage or other space.

Audio transducer 21000 may be coupled to processor 12000 and may include a microphone, speaker, or other audio transducer. The microphone is mounted in a position to receive local audio from a caller located outside of the garage. In one embodiment, audio transducer 21000 includes a microphone mounted on the external surface of the structure (or garage) having door opener 1000. Alternatively, the transducer is mounted in the interior of the garage and an orifice is provided in the garage wall to pick up sounds external to the garage. Transducer 21000, in conjunction with processor 12000, provides a voice recognition system that enables voice control of operation of door opener 1000, or other actuators.

Figure 36 graphically presents a block diagram of the functions performed by the programming executing on processor 12000. Programming 15000 includes, in various embodiments, web server programming 24000, auxiliary sensors programming 26000, door opener programming 21500, auxiliary actuator programming 28500 and voice recognition programming 31000. Programming may include circuitry, logical gates, software, or other elements.

Web server programming 24000 provides an interface to allow remote control of system 10000. For example, and not by way of limitation, server programming 24000 may include a wireless application protocol (WAP) server that couples to a telephone (or other communication) network to allow a user to operate, program and monitor system 10000. In one embodiment, a WAP server generates data that can be accessed using an Internet browser. In such a case, for example, the user can remotely configure system 10000 to turn off heater (part of HVAC system 20000) anytime door 4000 is open and the exterior temperature (as determined by temperature sensor 17500) is below 50 degrees Fahrenheit. As another example, the user can remotely configure system 10000 to block operation of door opener 1000 in response to voice commands (received by audio transducer 21000) from a selected person. Data for the user-selected programming may be stored in memory coupled to processor 12000. These and other programming configurations are contemplated.

Auxiliary sensors programming 26000 may include position sensor programming 26500, temperature sensor programming 27500, and optical sensor programming 27000. Position sensor programming 26500 may include software routines and modules that receive and interpret position information derived from door position sensor 16500. Optical sensor programming 27000 may include software routines and modules that receive and interpret information from optical sensor 17000. Temperature sensor programming may include software routines and modules that receive and interpret information from temperature sensor 17500. Other sensors, and appropriate programming, are also contemplated.

Door programming may include position sensor programming 22000 and actuator programming 22500. Position sensor programming 22000 may include software routines and modules that receive and interpret position information derived from a door position sensor as part of door opener 1000. Actuator programming may include door open programming 23000 and door close programming 23500. Door open programming 23000 may include software routines and modules that raise door 4000 in response to commands received by processor 12000. Door close programming 23500 may include software routines and modules that lowers door 4000 in response to commands received by processor 12000. Both door open programming 23000 and door close programming 23500 may also include programming that executes instructions in accordance with user specified, or predetermined, configurations. Door close programming 23500 may also check for obstructions in operating the door before instructing door opener 1000 to move to a closed position.

Auxiliary actuator programming may include, for example, courtesy light control programming 29000, HVAC programming 30000 and service door control programming 29500. Courtesy light control programming 29000 may include software routines and modules that control the operation of an interior, or exterior, courtesy light associated with the garage and coupled to processor 12000 by courtesy light controller 19000. HVAC programming 30000 may include software routines and modules that control the operation of HVAC system 20000 coupled to processor 12000. Service door control programming

29500 may include software routines and modules that control the operation of service door operator 19500 coupled to processor 12000.

Programming also may include voice recognition programming 31000. Voice recognition programming 31000 may include software programming for recognizing and executing instructions commensurate with a voice recognition system. The voice recognition system allows a user to speak into audio transducer 21000 and gain control over the operation of system 10000. Programming 31000 may include a security function to authenticate a voice command received by audio transducer 21000 before executing any instructions to operate door opener 1000.

Other programming functions are also contemplated. For example, a predetermined default setting can be configured to control the operation of system 10000 in the absence of a user specified configuration. The user may specify a desired configuration by providing instructions through audio transducer 21000, transceiver 13000, or a remote link using web server programming 24000.

Programming 15000 may also include software routines or modules to address prioritization matters. With multiple devices configured to independently control the operation of a single door opener, a problem may arise if conflicting commands are simultaneously received by the system. For example, a conflict arises if a first user transmits a long range communication to open the garage door and at the same time (or shortly thereafter) a second user transmits a short range communication to close the same door. A conflict may also arise if a first user attempts to operate a door using a wired button while a second user attempts to operate the same door using a transmitter compatible with a short range protocol of the present system 10000. In such cases, programming 15000 executing on processor 12000 will execute a routine to determine priority of each received command and suppress lower priority commands. For example, in one embodiment, the long range protocol may be configured to be inferior to that of short range protocol and, in turn, the short range protocol may be inferior to directly wired switch coupled to opener 1000. Other priority configurations may also be established. For example,

prioritization may be determined on the basis of proximity to opener 1000, on the basis of identity of a transmitter, on the basis of signal strength received by transceiver 13000, on the basis of recency of last communication, or on any other basis. In one embodiment, the user is empowered to establish a desired configuration. A default configuration may also be provided which is operable in the event that a user-defined configuration is not operable.

Programming 15000 may include instructions to cause processor 12000 to transmit position information, or any other information, using all modes of communication. In one embodiment, the user is afforded an opportunity to specify the distribution of position information. For example, the user may specify that position information is to be transmitted using only a long range communication protocol during specified hours and to a particularly specified user or group of users.

Programming 15000 may also enable processor 12000 to communicate with a building security system or control system. For example, in the event of a particular detected security event, door opener 1000 may be instructed to either close or open.

Figure 37 includes a flow chart describing method 35000 involving one embodiment of the present system. Method 35000 describes operation of system 10000 for receiving door position information and for controlling the door from a remote location.

The method starts at item 35500 and assumes that the user has a wireless device capable of communicating with transceiver 13000. At 36000, the user and system 10000 establish a link on a communication channel. At 36500, door position information is received by the user. In one embodiment, sensor 15500 provides the position information to processor 12000. At 37000, the user receives notification of the door position information. The door position may be indicated by a pair of lights on a pager (one light labeled "open" and another "close"), by a graphical image on a screen, a recognizable audio tone, a recognizable vibration, or any other means of indicating position to a user. At 37500, the user is presented with one or more options to control system 10000. In the case that door 4000 is open, options may include partially, or fully, closing

the door. A single option may be presented that allows the user to toggle the position of the door between a closed and an open position. The option may be a button or several buttons. At 38000, the user indicates a selection using the portable wireless device. At 38500, the wireless device encodes a message for transmission to system 10000 including instructions to operate the door according to the user selection. At 39000, the message is transmitted to system 10000. The message may be routed to system 10000 on wired or wireless communication networks. The method ends at 39500.

Other Embodiments

In one embodiment, system 10000 is coupled to multiple door openers 1000. For example, many homes include two or more garages, each having an individual door opener. Also, commercial applications often include multiple overhead doors, each having an individual door opener. In such cases, multiple door openers 1000 may be coupled to a single system 10000 which controls and reports the operation of each door opener.

In one embodiment, programming 15000 allows a user having a cellular telephone in communication with system 10000 to control and monitor each of several door openers 1000, or other systems coupled to processor 12000. In one embodiment, programming 15000 allows a user to control and monitor a single door opener 1000, or other system coupled to processor 12000. Identification and group membership routines implemented by processor 12000 and programming 15000 allow for a superior user to configure the authority of multiple inferior users over multiple door openers 1000, each coupled to processor 12000, using system 10000.

The present system has been described, in part, relative to the operation of a garage door opener. However, it will be noted that other doors may be controlled and operated using a suitable power opener. The actuator for many garage door openers is electrically operated, however, it is understood that an actuator operable with the present system may include a pneumatically or hydraulically operated actuator. Furthermore, it will be appreciated that, in addition to operating a door, the present system and method may be adapted for use with other controls, such as a window control, Venetian blind control,

skylight control, or other operable device or actuator. By way of example, the present system and method may be adapted to operate with a pet access door, a house entry door, an interior swing door, a patio sliding door, a pocket door, an apartment entry door, a sliding window, or an elevator or lift access door. For instance, the present system may be adapted for use with a handicap access door.

In one embodiment, system 10000 includes circuitry and programming to detect proximity of a compatible transceiver. For example, system 10000 may include a BLUETOOTH® compatible transceiver which implements a self-aware feature to determine the presence of a compatible device within effective range. Thus, if system 10000 detects that a compatible device is within range, then a preprogrammed function is executed. Security systems or authorization systems are included in system 10000 to ensure that any detected compatible device is authorized to exercise control over system 10000. For instance, and in one embodiment, if a BLUETOOTH® equipped wireless garage door opener is brought within a predetermined range, then system 10000 automatically operates an electric garage door opener. In particular, if the door is closed at a time when the door opener is brought within range, then system 10000 operates to open the door and if the door is open at a time when the door opener is brought within range, then system 10000 operates to close the door. As another example, one embodiment of the present system 10000 includes a BLUETOOTH® equipped wireless pet collar and a BLUETOOTH® equipped pet door opener. The pet door is thus automatically opened when a dog wearing the collar approaches the door. As yet another example, one embodiment of the present system 10000 includes a BLUETOOTH® equipped module and a BLUETOOTH® equipped handicapped-person accessible door opener. The handicapped-person accessible door is thus automatically opened when a person carrying the module approaches the door. The module may be affixed to a wheelchair or other device.

Conclusion

Other embodiments are possible and the examples provided herein are intended to be demonstrative and not exclusive or exhaustive of the present invention, which is determined by the scope of the appended claims and the full range of equivalents to which they are entitled.

WHAT IS CLAIMED IS:

1. A device comprising:

a security sensor for detecting a condition; and

a wireless transceiver electrically coupled to the sensor, the wireless transceiver for communicating with the security sensor, the wireless transceiver adapted for monitoring a radio frequency for an incoming digital message in a network protocol and adapted for retransmission of digital messages in the network protocol.

2. The device of claim 1 wherein the wireless transceiver operates on a frequency of approximately 2.45GHz.

3. The device of claim 1 or 2 wherein the wireless transceiver is substantially compatible with standards under IEEE 802.15.

4. The device of any of claims 1 to 3 wherein the wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

5. The device of any of claims 1 to 4 wherein the security sensor comprises a motion sensor, a passive infrared (PIR) motion detector, a pressure sensor, a position sensor, a proximity sensor, a glass breakage sensor, or a video camera.

6. The device of any of claims 1 to 5 further comprising an environmental sensor, the environmental sensor coupled to, and in communication with, the wireless transceiver.

7. The device of claim 6 wherein the environmental sensor comprises a temperature sensor, a gas sensor, a particulate sensor, a fluid sensor, or a sound sensor.

8. The device of any of claims 1 to 7 further comprising a control coupled to, and in communication with, the wireless transceiver.

9. The device of claim 8 wherein the control comprises a power control, an appliance control, an air conditioner control, a furnace control, or a ventilation control.

10. The device of any of claims 1 to 9 further comprising an operable security device coupled to the wireless transceiver.

11. The device of claim 10 wherein the operable security device comprises a lock or a siren.

12. The device of any of claims 1 to 11 wherein the wireless transceiver relays communications between a plurality of other wireless transceivers.

13. The device of any of claims 1 to 12 wherein the wireless transceiver communicates with a long range, bidirectional wireless network.

14. The device of any of claims 1 to 13 wherein the wireless transceiver communicates with a telephone, a cellular telephone, a pager, a computer, a personal communication service (PCS) device, a narrowband PCS device, a two-way pager, or a personal data assistant.

15. The device of any of claims 1 to 14 wherein the sensor and the wireless transceiver are powered by battery or metered electric service.

16. A system comprising:

a security device;

a first wireless transceiver electrically coupled to the security device, the first wireless transceiver adapted for communicating with the security device, monitoring a plurality of radio frequencies, retransmitting digital data in a digital

network protocol, receiving outbound data from the security device and wirelessly transmitting the outbound data using the digital network protocol, and adapted for wirelessly receiving incoming digital data in the network protocol and communicating the incoming digital data to the security device; and

a second wireless transceiver in communication with the first wireless transceiver, the second wireless transceiver adapted for monitoring the plurality of radio frequencies, receiving and retransmitting digital data in the digital network protocol, communicating outgoing data to a user, and transmitting the incoming digital data.

17. The system of claim 16 wherein the first wireless transceiver is a spread spectrum transceiver.

18. The system of claim 16 or 17 wherein the first wireless transceiver is substantially compatible with standards under IEEE 802.15.

19. The system of any of claims 16 to 18 wherein the first wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

20. The system of any of claims 16 to 19 wherein the second wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

21. The system of any of claims 16 to 20 wherein the second wireless transceiver is electrically coupled to a user controllable communication device.

22. The system of claim 21 wherein the user controllable communication device is in communication with a user.

23. The system of any of claims 16 to 22 wherein the second wireless transceiver is coupled to a telephone line, a long range transceiver, a cellular

communication network, a narrowband personal communication system network, a modem, a packetized communication network, or the Internet.

24. The system of any of claims 16 to 23 wherein the security device and the first wireless transceiver are battery powered or line voltage powered.

25. A system comprising:

a first module including:

a microprocessor controller;

a lock coupled to the controller;

an audio transducer coupled to the controller, the audio transducer for generating an electrical signal in response to received audio and for generating audio in response to a received electrical signal;

a caller accessible identification module coupled to the controller, the caller accessible identification module for receiving caller entered information;

a proximity detector coupled to the controller, the proximity detector for signaling the presence of a caller near the exterior module; and

a first wireless transceiver coupled to the controller, the first wireless transceiver transmitting a digital signal received from the controller, the first wireless transceiver monitoring a radio frequency for an incoming digital message in a network protocol and for communicating digital data in the network protocol upon receiving an incoming digital message; and

a second module including:

a second wireless transceiver in wireless communication with the first wireless transceiver, the second wireless transceiver monitoring a radio frequency for an incoming digital message in a network protocol and for communicating digital data in the network protocol upon receiving an incoming digital message; and

a user accessible control panel electrically coupled to the second wireless transceiver.

26. The system of claim 25 wherein the first wireless transceiver is substantially compatible with standards under IEEE 802.15.

27. The system of claim 25 or 26 wherein the first wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

28. The system of any of claims 25 to 27 wherein the second wireless transceiver is substantially compatible with standards under IEEE 802.15.

29. The system of any of claims 25 to 28 wherein the second wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

30. The system of any of claims 25 to 29 wherein the first module is battery operated.

31. The system of any of claims 25 to 30 wherein the audio transducer comprises a speaker and a microphone.

32. The system of any of claims 25 to 31 further comprising a third wireless transceiver in communication with the first wireless transceiver and the second wireless transceiver and the third wireless transceiver is further coupled to a long range communication network.

33. The system of any of claims 25 to 32 wherein the first module further comprises a video camera and the second module comprises a video display.

34. The system of any of claims 25 to 33 wherein the proximity detector comprises a doorbell button or a video camera.

35. The system of any of claims 25 to 34 wherein the user accessible identification module comprises a keypad, a biometrics sensor, or a card reader.

36. A device comprising:

a clock;

a wireless transceiver coupled to the clock, the wireless transceiver operable for retransmitting a digital signal, the wireless transceiver monitoring a radio frequency for an incoming digital message in a network protocol and for communicating digital data in the network protocol upon receiving an incoming digital message;

a first control accessible to the user and coupled to the transceiver, wherein actuation of the first control effectuates one of a plurality of user selectable outputs, the user selectable outputs each coupled wirelessly to the device; and

a second control accessible to the user, wherein actuation of the second control selects a time for activating the one of a plurality of user selectable outputs.

37. The device of claim 36 wherein the plurality of user selectable outputs effectuatable by the first control comprises activating a security system, controlling an environmental control, or controlling a premises control.

38. The device of claim 36 or 37 wherein the second control accessible to the user enables the user to select an absolute time, a predetermined time or a default time.

39. The device of any of claims 36 to 38 wherein the wireless transceiver communicates using an omnidirectional communication channel, the wireless transceiver having ad hoc networking capability.

40. The device of any of claims 36 to 39 wherein the wireless transceiver is substantially compatible with standards under IEEE 802.15.

41. The device of any of claims 36 to 40 wherein the wireless transceiver is compatible with BLUETOOTH® technical specification version 1.0.

42. A method of communicating comprising:

receiving a request for service from a caller using an annunciator module;

transmitting the request as a digital message in a wireless, premises-based network protocol;

receiving the request at a remote location using a personal communication device; and

notifying a user of the device of the received request.

43. The method of claim 42 wherein wirelessly transmitting the request comprises transmitting the encoded request using communication technology substantially compatible with standards under IEEE 802.15.

44. The method of claim 42 or 43 wherein wirelessly transmitting the request comprises transmitting using BLUETOOTH® technical specification version 1.0.

45. The method of any of claims 42 to 44 further comprising:

acknowledging receipt of the signal; and

communicating between the module and the device.

46. The method of any of claims 42 to 45 wherein communicating between the module and the device comprises communicating a video image between the module and the device.

47. The method of any of claims 42 to 46 further comprising:

sending an executable command from the device;

receiving the executable command at the module; and

executing the instruction.

48. The method of claim 47 wherein sending an executable command comprises sending an executable command to operate a door lock.

49. A method, comprising:

entering a predetermined code into a portable transmitter;

transmitting the code as a digital message in a wireless, premises-based network protocol;

receiving the code at a receiver coupled to an operable device;

verifying authorization of the transmitted code; and

operating the device.

50. The method of claim 49 wherein wirelessly transmitting the code as a digital message in a network protocol comprises transmitting using communication technology substantially compatible with standards under IEEE 802.15.

51. The method of claim 49 or 50 wherein transmitting the code as a digital message comprises transmitting using BLUETOOTH® technical specification version 1.0.

52. The method of any of claims 49 to 51 wherein operating the device comprises unlocking a door lock or operating an electric light.

53. A method of operating a security system, comprising:

detecting the position of a bolt;

transmitting information corresponding to the detected position using a wireless radio frequency link in a digital, premises-based network protocol;

receiving the transmitted information; and

operating a security system as a function of the received information.

54. The method of operating a security system of claim 53 wherein operating a security system as a function of the received information comprises operating

perimeter sensors when the bolt is detected in a first position and operating perimeter sensors and interior sensors when the bolt is detected in a second position.

55. The method of operating a security system of claim 53 or 54 further comprising detecting a video image using an interior camera and wherein operating a security system further comprises operating a security system as a function of the bolt position and the detected video image.

56. The method of operating a security system of any of claims 53 to 55 wherein transmitting information corresponding to the detected position using a wireless radio frequency link in a digital network protocol comprises transmitting information corresponding to the detected position using communication technology substantially compatible with standards under IEEE 802.15.

57. The method of operating a security system of any of claims 53 to 56 wherein transmitting information corresponding to the detected position using a wireless radio frequency link in a digital network protocol comprises transmitting information corresponding to the detected position using BLUETOOTH® technical specification version 1.0.

58. A method of remotely operating a security system, comprising,

executing programming on a portable communication device;

generating a visual display of options for controlling the security system;

selecting operational parameters for the security system using the display;

executing a command to implement the selected operational parameters; and

transmitting the command and selected parameters to the security system using a wireless radio frequency link in a digital, premises-based network protocol.

59. The method of claim 58 wherein transmitting the command and selected parameters comprises transmitting the command and selected parameters on a communication channel substantially compatible with standards under IEEE 802.15.

60. The method of claim 58 or 59 wherein transmitting the command and selected parameters comprises transmitting the command and selected parameters using BLUETOOTH® technical specification version 1.0.

61. A building management system comprising:

a transducer for generating data upon detecting a local event;

a first communication module coupled to the transducer, the first communication module including a first transceiver for wirelessly transmitting transducer data in a premises-based, digital network protocol; and

a second communication module for wirelessly communicating with the first communication module, the second communication module further including:

a second transceiver for communicating with the first communication module using the digital network protocol; and

a user operable device coupled to the second transceiver, the user operable device adapted for communicating with the transducer via the digital network protocol.

62. The building management system of claim 61 wherein the first communication module and the second communication module communicate using communication technology substantially compatible with standards under IEEE 802.15.

63. The building management system of claim 61 or 62 wherein the first communication module and the second communication module communicate using BLUETOOTH® technical specification version 1.0.

64. The building management system of any of claims 61 to 63 wherein the first communication module further comprises a controllable member, wherein the controllable member is operated as a function of the user operable device.

65. A method of communicating, comprising:

detecting a user controlled action;

generating encoded data as a function of the user controlled action;

transmitting the encoded data to a remote facility using a premises-based, digital network protocol;

receiving the encoded data at the remote facility; and

initiating an emergency response as a function of the encoded data.

66. The method of claim 65 wherein transmitting the encoded data to a remote facility using a digital network protocol comprises transmitting the encoded data to a remote facility using communication technology substantially compatible with standards under IEEE 802.15.

67. The method of claim 65 or 66 wherein transmitting the encoded data to a remote facility using a digital network protocol comprises transmitting the encoded data to a remote facility using BLUETOOTH® technical specification version 1.0.

68. The method of any of claims 65 to 67 wherein initiating an emergency response comprises summoning fire suppression aid, summoning police service, or summoning medical aid.

69. The method of any of claims 65 to 68 wherein detecting a user controlled action comprises detecting a keystroke, a touch screen input, or an audible command.

70. The method of any of claims 65 to 69 wherein generating encoded data comprises generating encoded data indicative of a fire emergency, a police emergency or a medical emergency.

71. A system comprising:

a passive infrared motion detector; and

a transmitter coupled to the detector, the transmitter is compatible with BLUETOOTH® technical specification version 1.0.

72. The system of claim 71 wherein the transmitter is substantially compatible with standards under IEEE 802.15.

73. The system of claim 71 or 72 further comprising a receiver coupled to the detector, the receiver is compatible with BLUETOOTH® technical specification version 1.0.

74. The system of claim 73 wherein the receiver is substantially compatible with standards under IEEE 802.15.

75. A system comprising:

a passive infrared motion detector; and

a transmitter coupled to the detector, the transmitter is compatible with BLUETOOTH® technical specification version 1.0; and

a long range communication module, the module adapted for communicating with the detector using the transmitter and further wherein the module is coupled to a long range communication network.

76. The system of claim 75 further comprising a receiver coupled to the detector, the receiver compatible with BLUETOOTH® technical specification version 1.0 and wherein the module is adapted for communicating with the detector using the receiver.

77. The system of claim 75 or 76 wherein the long range communication network is a telephone network, a cellular telephone network, a radio network, a personal communication system network, or a two-way pager network.

78. A device comprising:

a processor adapted for coupling to a door opener and having programming including instructions for generating a command to operate the door opener;

a first position sensor coupled to the processor and adapted for generating a first position signal based on a position of a first door coupled to the door opener;

a radio frequency transceiver coupled to the processor and adapted for transmitting the first position signal using a long range communication protocol and a short range communication protocol, and for receiving a wireless signal using the long range communication protocol and the short range communication protocol, the transceiver including circuitry for spread spectrum frequency hopping and wherein the command is based on the wireless signal.

79. The device of claim 78 wherein the transceiver is adapted for communicating on a protocol compatible with a cellular telephone communication protocol.

80. The device of claim 78 or 79 wherein the transceiver is adapted for communicating on a protocol compatible with a pager communication protocol.

81. The device of any of claims 78 to 80 wherein the transceiver operates at a frequency of approximately 2.45 GHZ.

82. The device of any of claims 78 to 81 wherein the transceiver is substantially compatible with standards under IEEE 802.15 or substantially compatible with BLUETOOTH® technical specification version 1.0.

83. The device of any of claims 78 to 82 wherein the first position sensor includes a magnetic switch, a contact switch, or a camera.

84. The device of any of claims 78 to 83 further comprising a battery coupled to the processor and coupled to the transceiver.

85. The device of any of claims 78 to 84 further comprising an optical sensor coupled to the processor and adapted for generating a light level signal based on light intensity in a region proximate to the first door, and further wherein the transceiver is adapted for transmitting the light level signal.

86. The device of any of claims 78 to 85 further comprising a second position sensor coupled to the processor and adapted for generating a second position signal based on a position of a second door, and further wherein the transceiver is adapted for transmitting the second position signal.

87. The device of any of claims 78 to 86 wherein the processor includes programming having instructions for generating a web page accessible from the Internet.

88. The device of any of claims 78 to 87 further comprising an audio transducer coupled to the processor and further wherein the processor includes programming having instructions for operating the door opener in response to a vocal command received by the transducer.

89. A method of manufacturing a module comprising:
adapting a processor to couple with a door opener;
adapting the processor to couple with a first position sensor;
coupling a wireless transceiver adapted for spread spectrum frequency hopping to the processor;

adapting the transceiver to receive a first signal in a protocol compatible with a long range communication protocol and in a protocol compatible with a short range communication protocol;

adapting the transceiver to transmit information received from the first position sensor in a protocol compatible with a long range communication protocol and in a protocol compatible with a short range communication protocol; and

providing a program for executing on the processor, the program having instructions to cause the processor to operate the door opener based on the first signal.

90. The method of claim 89 wherein adapting the transceiver to receive a first signal in a protocol compatible with a long range communication protocol includes adapting the transceiver to receive the first signal in a protocol compatible with a long range cellular telephone communication protocol.

91. The method of claim 89 or 90 wherein adapting the transceiver to receive a first signal in a protocol compatible with a long range communication protocol includes adapting the transceiver to receive the first signal in a protocol compatible with a pager communication protocol.

92. The method of any of claims 89 to 91 further comprising providing a battery connector coupled to the processor and to the transceiver.

93. The method of any of claims 89 to 92 further comprising adapting the processor to couple with a second position sensor and wherein the transceiver is adapted for transmitting information received from the second position sensor.

94. The method of any of claims 89 to 93 further comprising adapting the processor to couple with an optical sensor and wherein the transceiver is adapted for transmitting a light level signal based on light intensity in a region proximate to a door coupled to the door opener.

95. The method of any of claims 89 to 94 further comprising adapting the processor to generate a command to open a door coupled to the door opener in response to an open signal received by the transceiver in a protocol compatible with the long range communication protocol.

96. The method of any of claims 89 to 95 further comprising adapting the processor to generate a command to open a door coupled to the door opener in response to an open signal received by the transceiver in a protocol compatible with the short range communication protocol.

97. The method of any of claims 89 to 96 further comprising adapting the processor to generate a command to close a door coupled to the door opener in response to a close signal received by the transceiver in a protocol compatible with the long range communication protocol.

98. The method of any of claims 89 to 97 further comprising adapting the processor to generate a command to close a door coupled to the door opener in response to a close signal received by the transceiver in a protocol compatible with the short range communication protocol.

99. The method of any of claims 89 to 98 further comprising adapting the processor to generate a web page accessible from the Internet.

100. The method of any of claims 89 to 99 further comprising adapting the processor to couple with an audio transducer and to operate the door opener in response to a vocal command received by the transducer.

101. A method of operating a door comprising:

establishing a wireless communication channel with a module coupled to the door;

transmitting a position signal on the channel based on a position of the door;

providing an indication to a user based on the position signal; and

receiving an instruction signal on the channel, the instruction signal based on a user selected option for operating the door.

102. The method of claim 101 wherein establishing a wireless communication channel with a module coupled to the door includes communicating using a protocol compatible with a cellular telephone, a protocol compatible with a pager or a protocol compatible with BLUETOOTH® technical specification version 1.0.

103. The method of claim 101 or 102 wherein providing an indication to a user based on the position signal includes providing a visual indication.

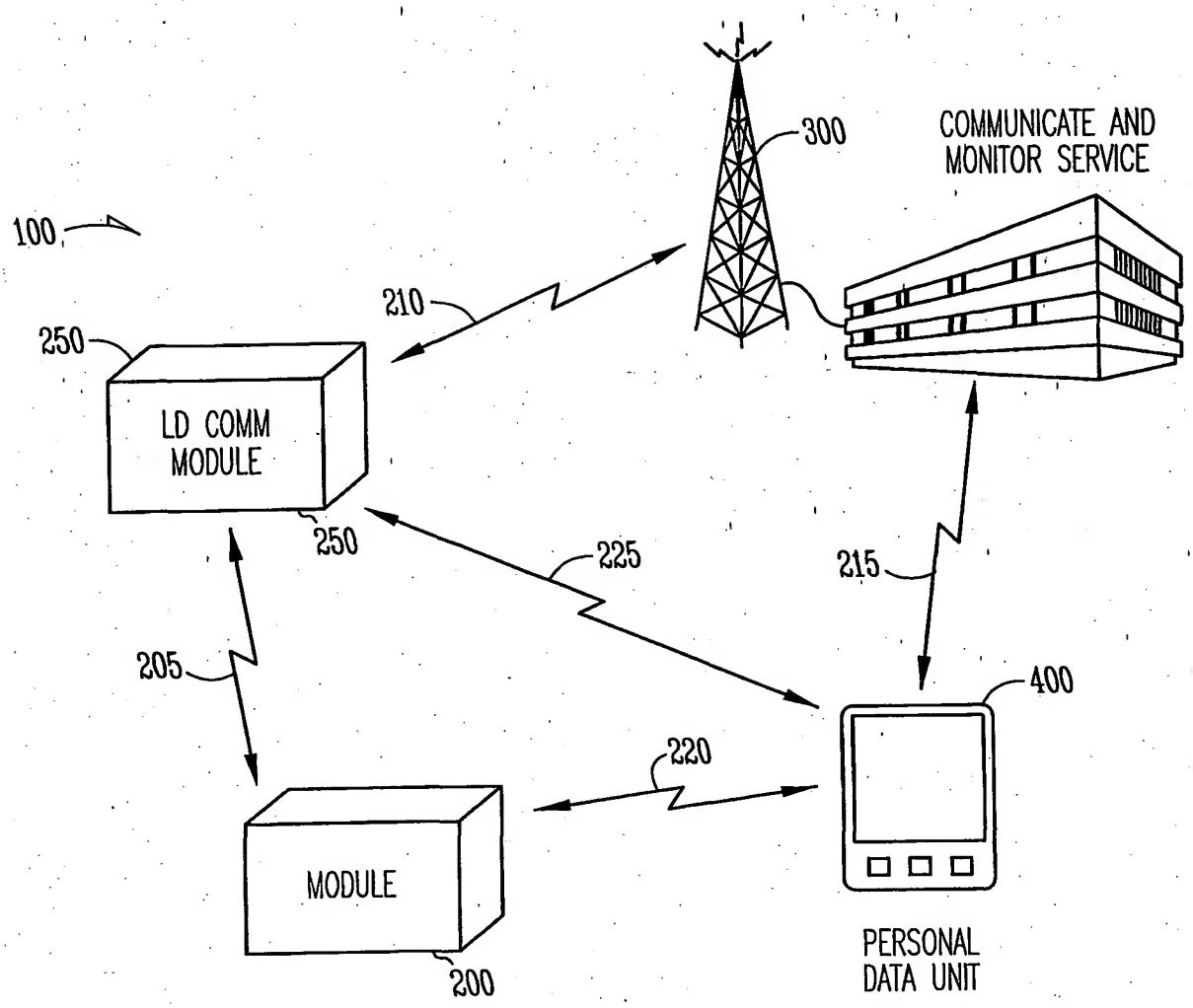


Fig. 1

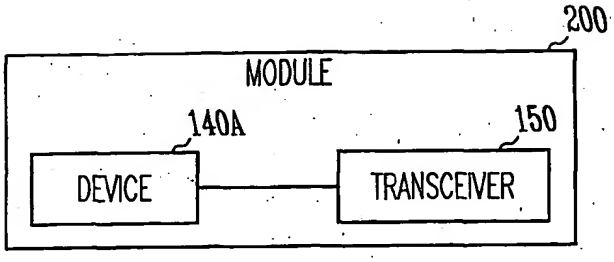


Fig.2A

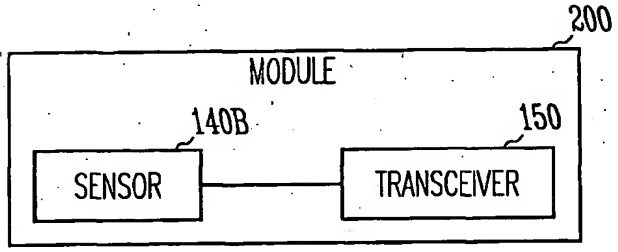


Fig.2B

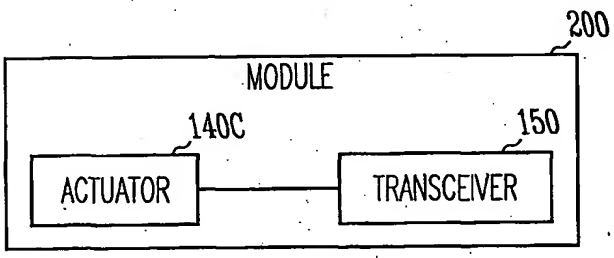


Fig.2C

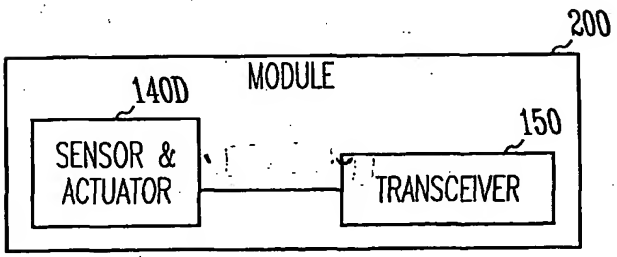


Fig.2D

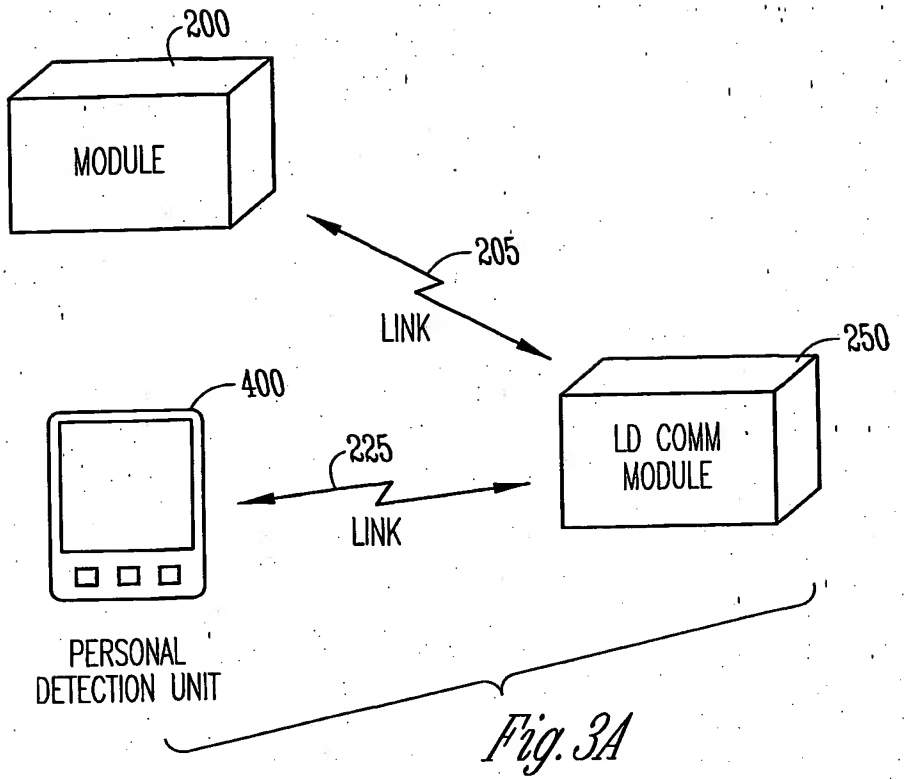


Fig. 3A

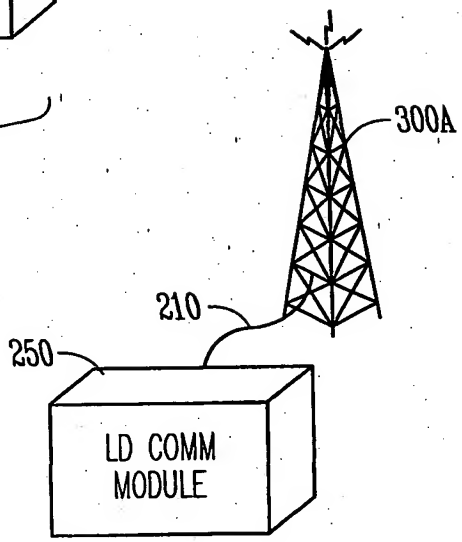


Fig. 3B

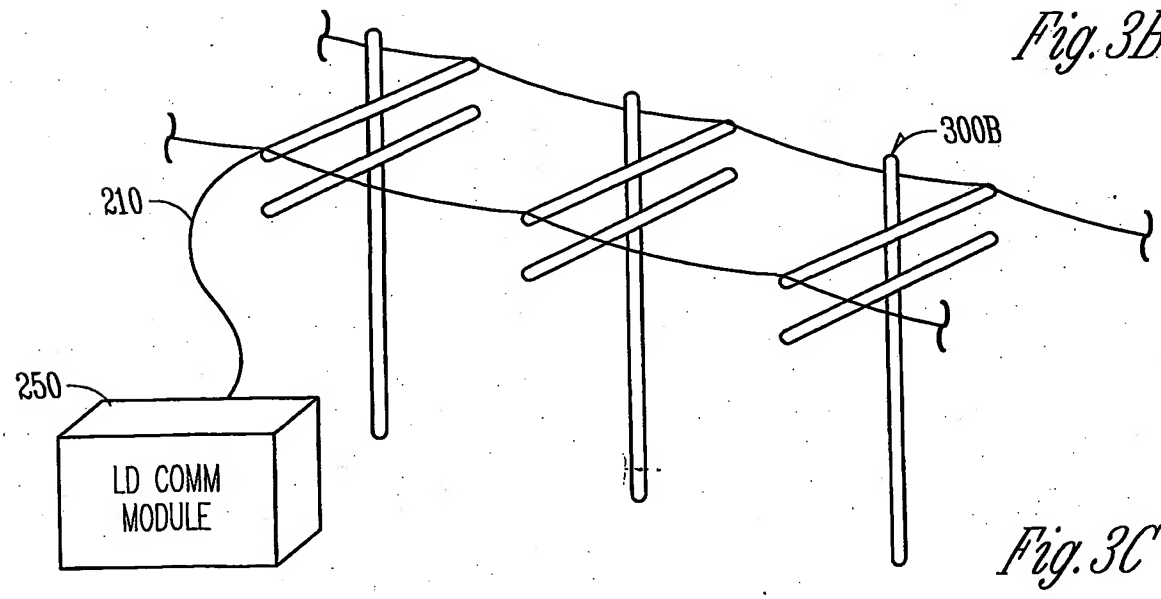


Fig. 3C

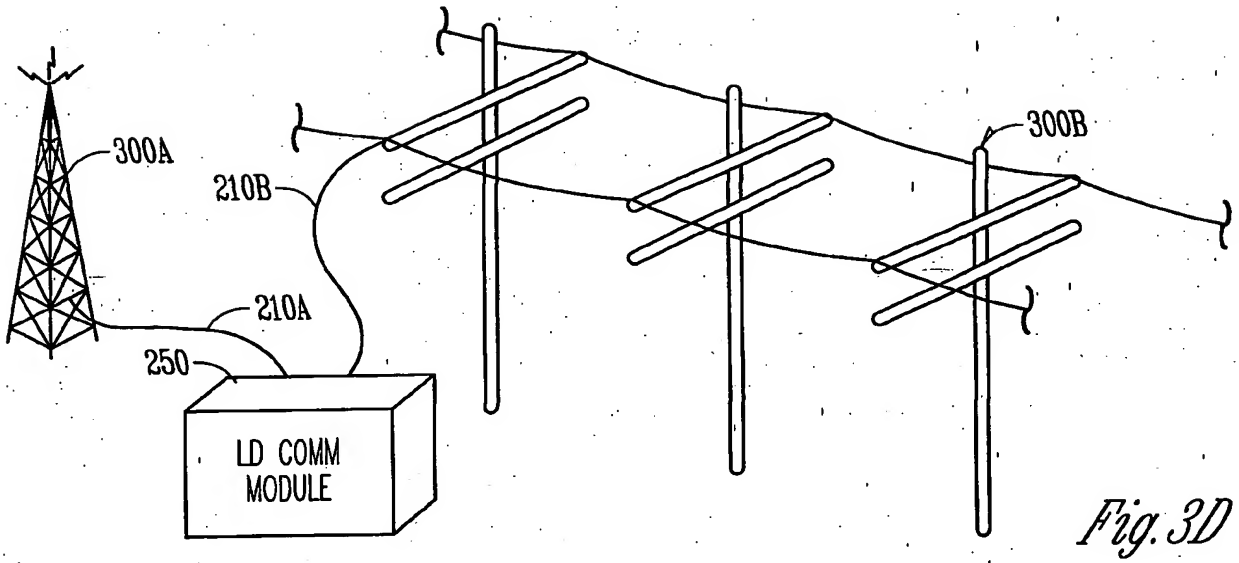


Fig. 3D

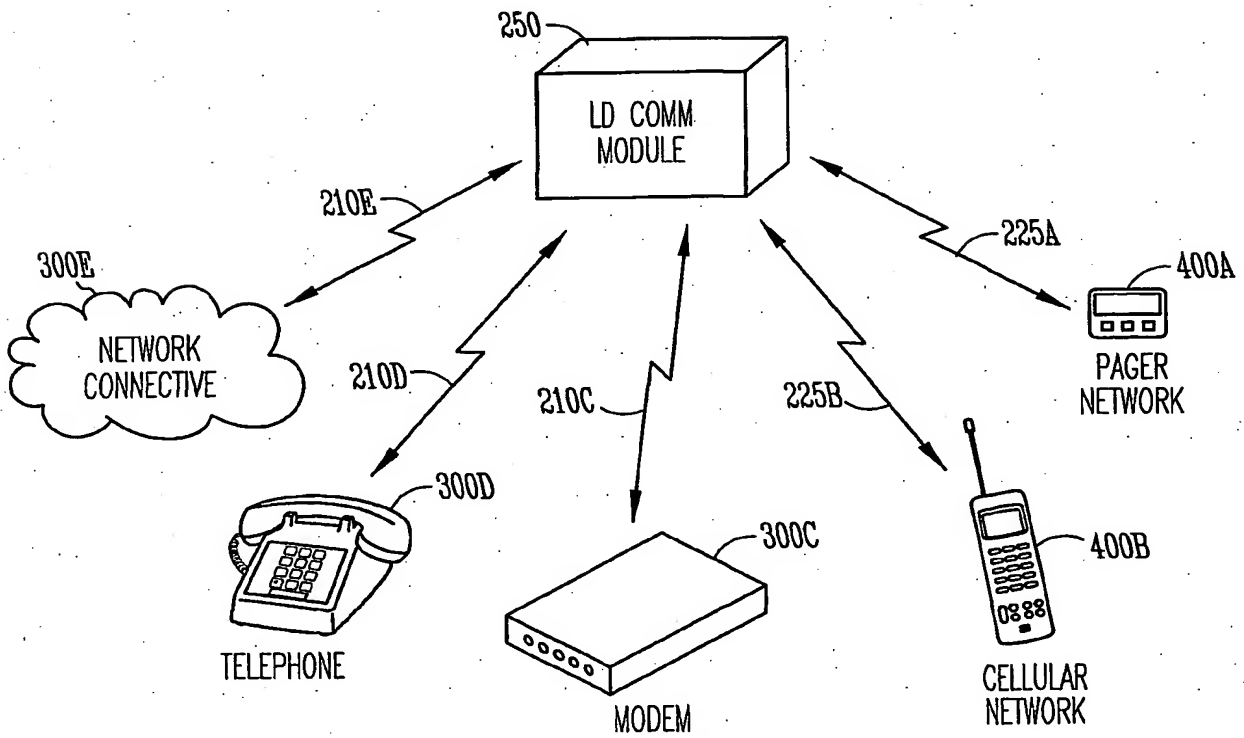


Fig. 4

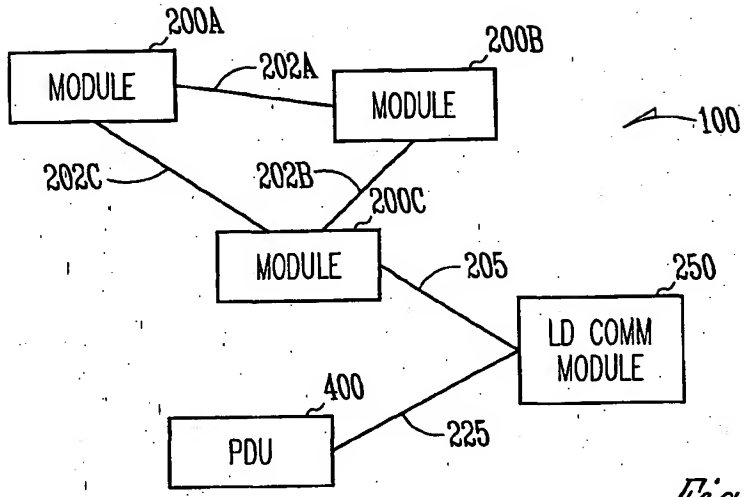
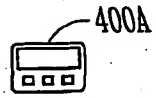
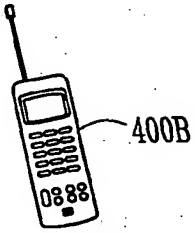


Fig. 5



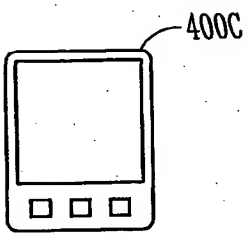
TWO-WAY PAGER

Fig. 6A



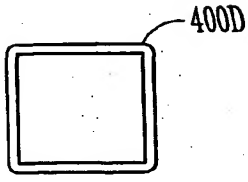
CELLULAR TELEPHONE

Fig. 6B



PERSONAL DATA ASSISTANT

Fig. 6C



PERSONAL COMMUNICATION DEVICE

Fig. 6D

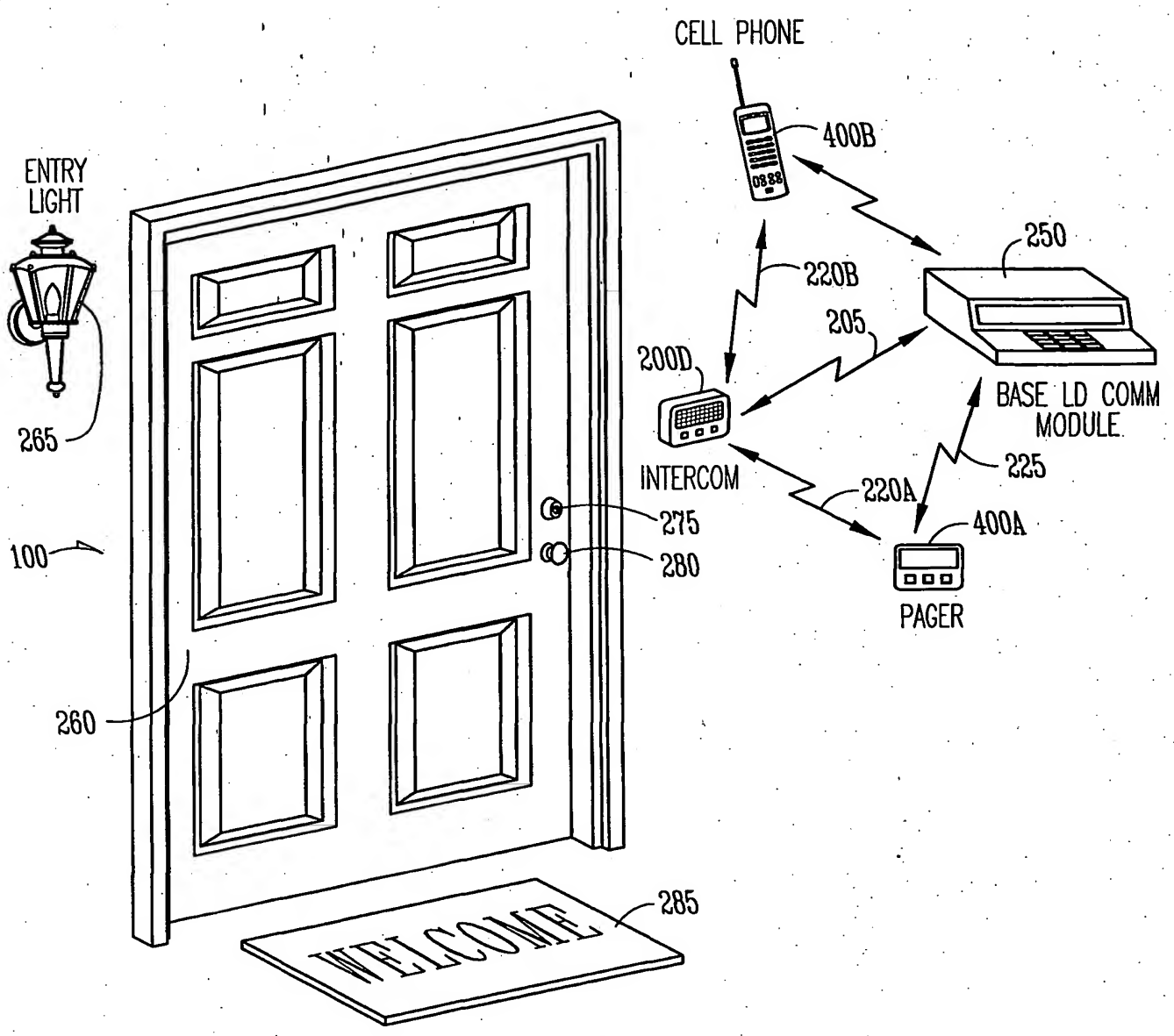


Fig. 7

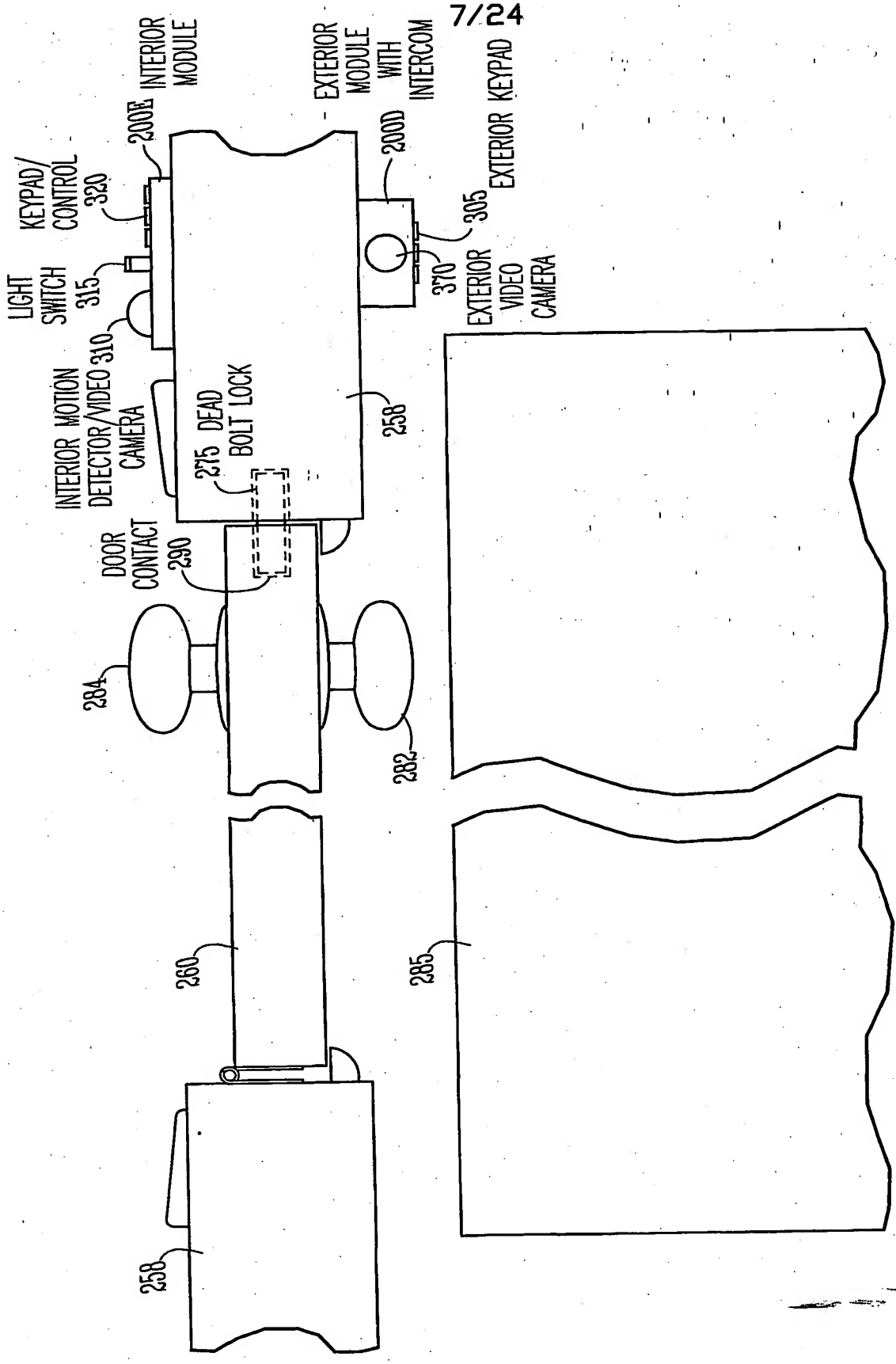


Fig. 8

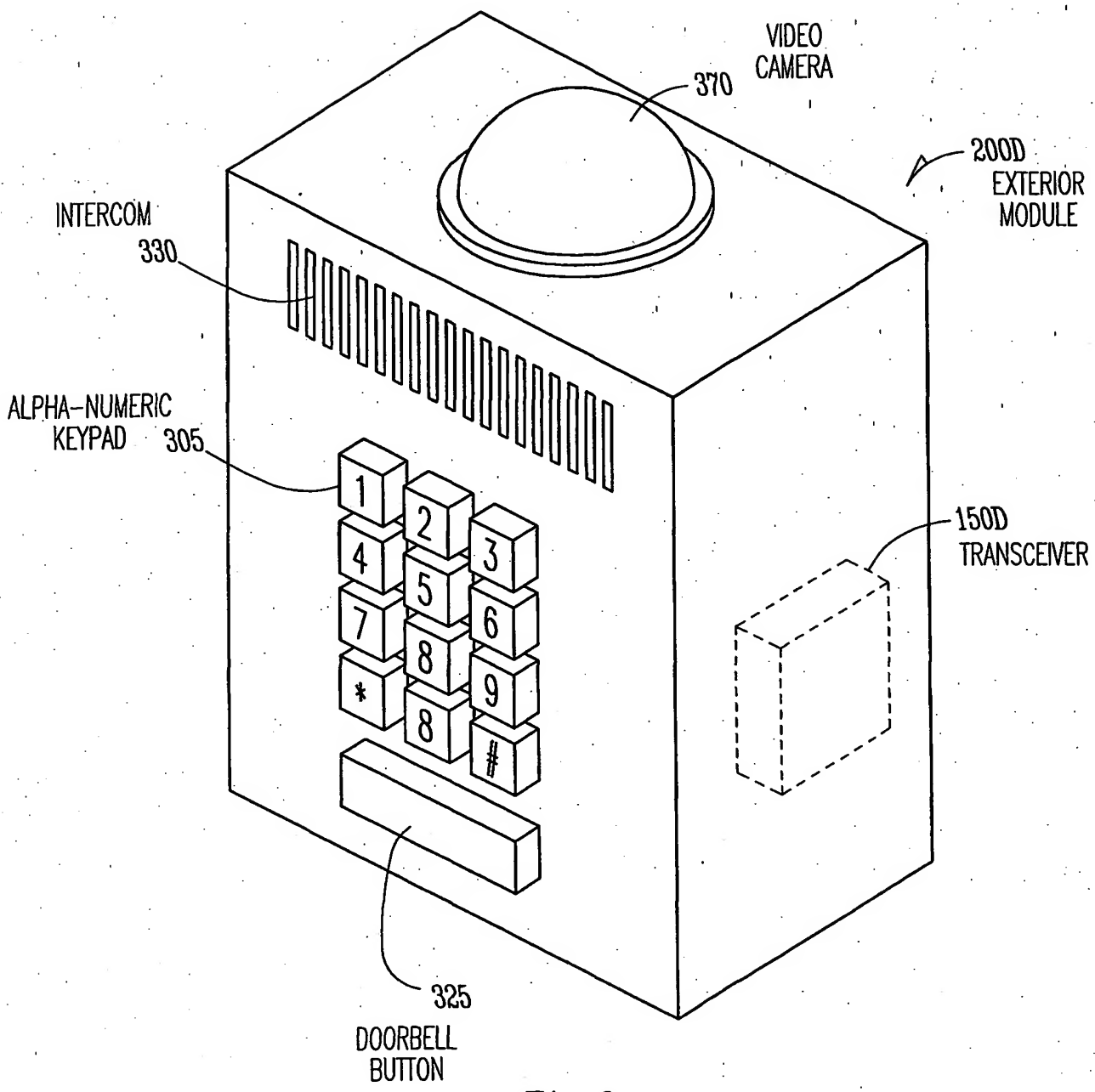


Fig. 9

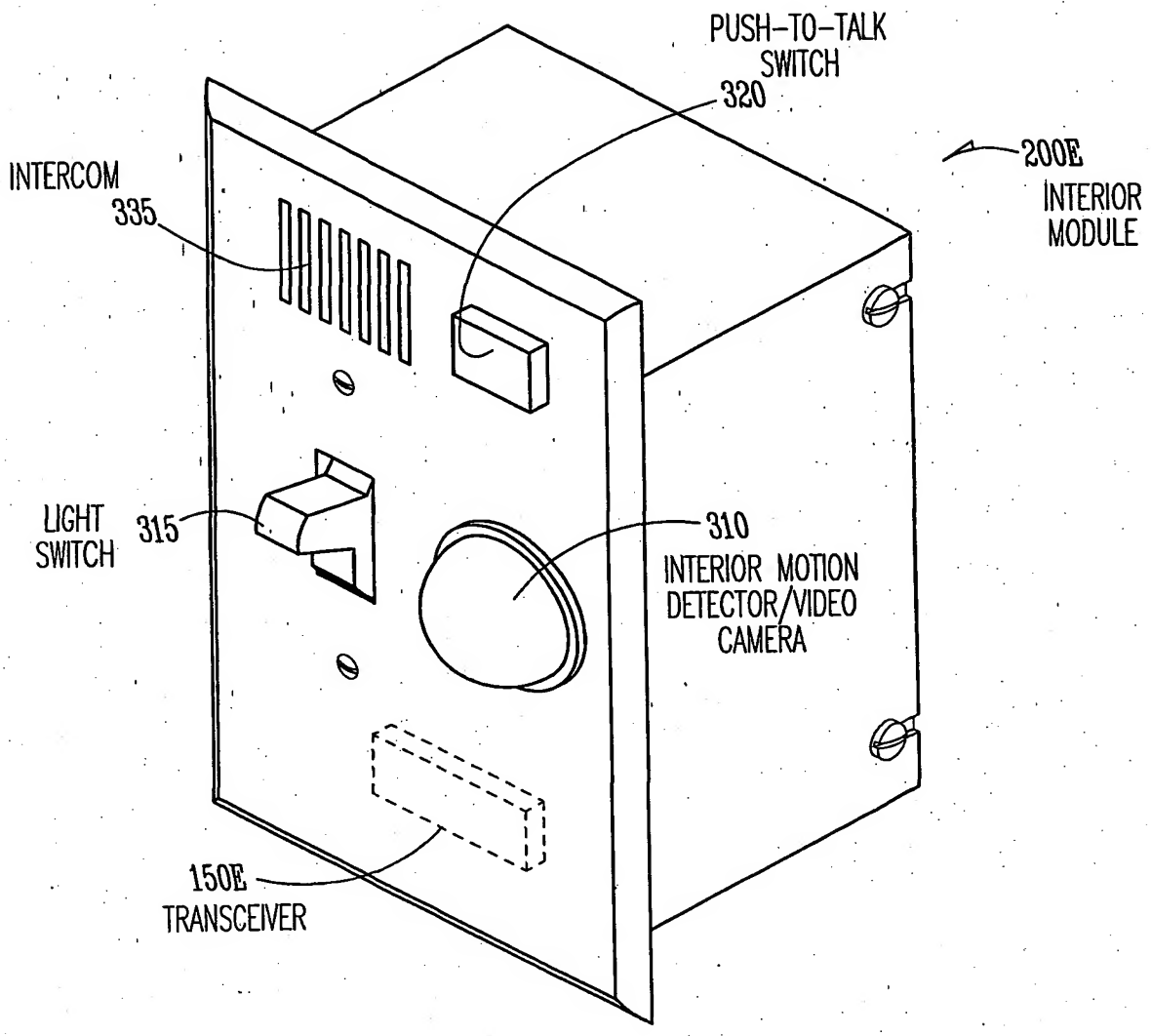


Fig. 10

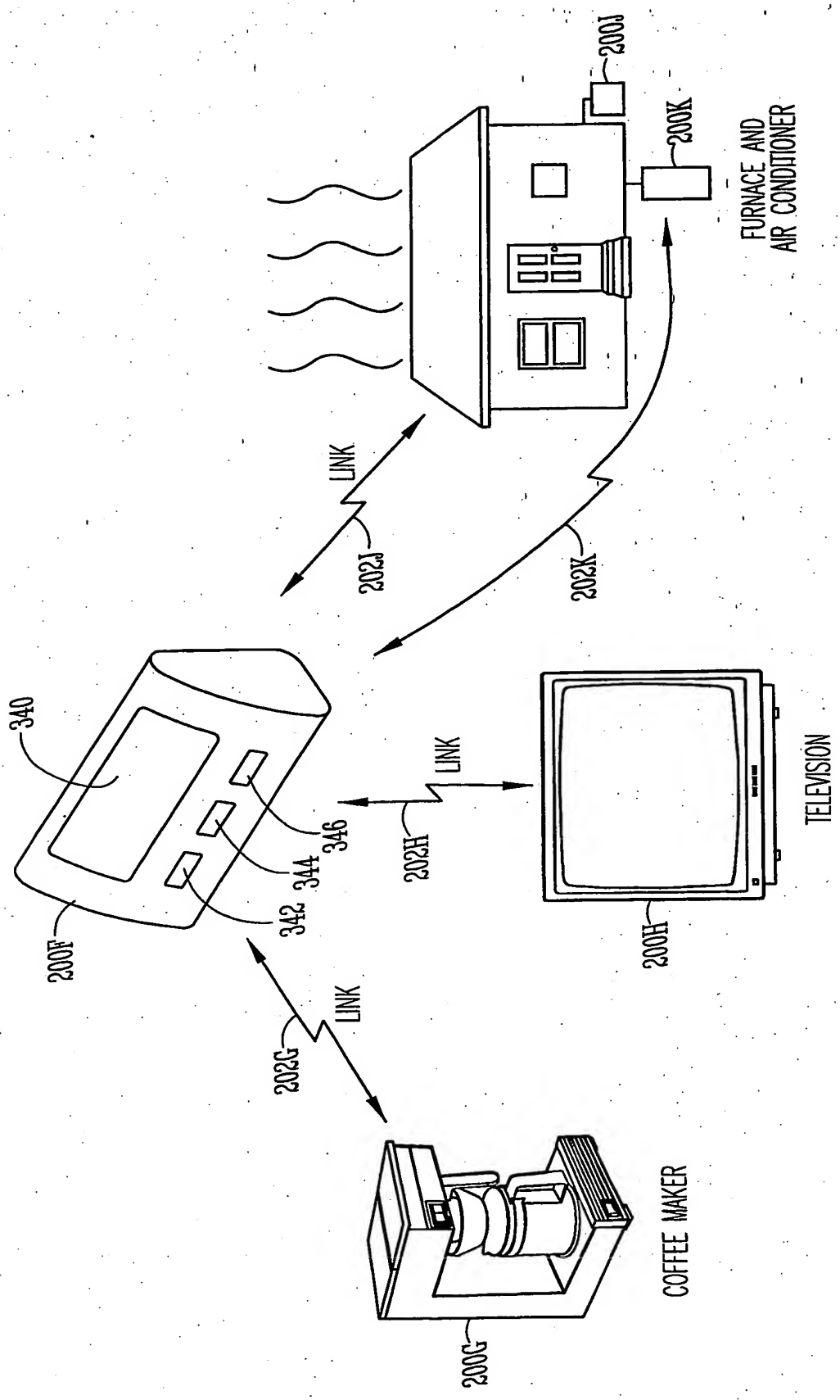


Fig. 11

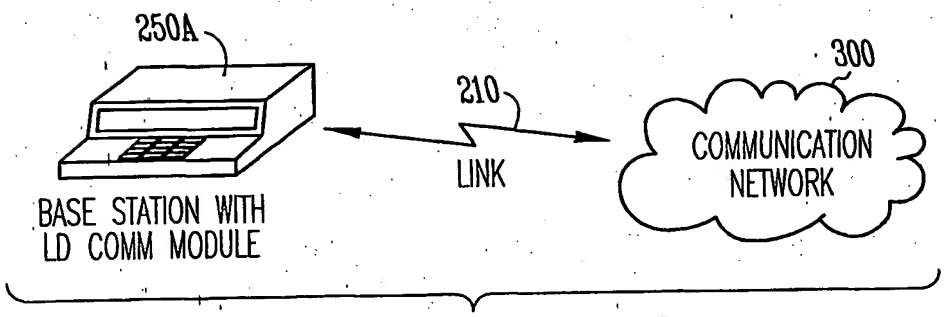


Fig. 12

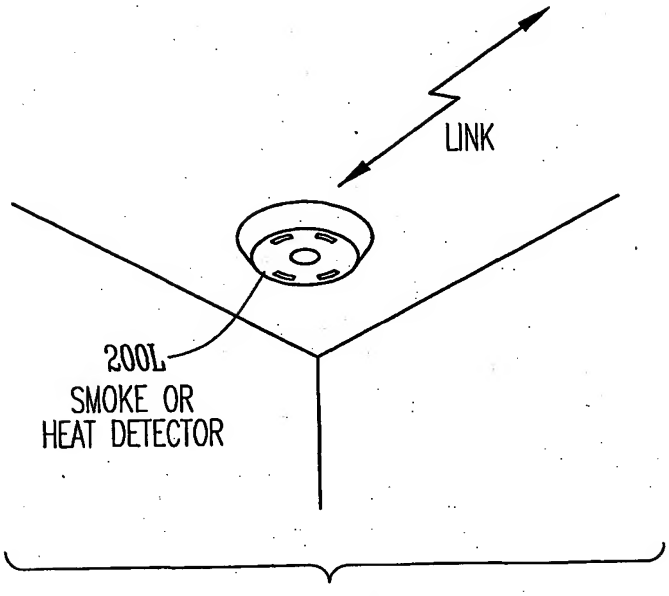


Fig. 13

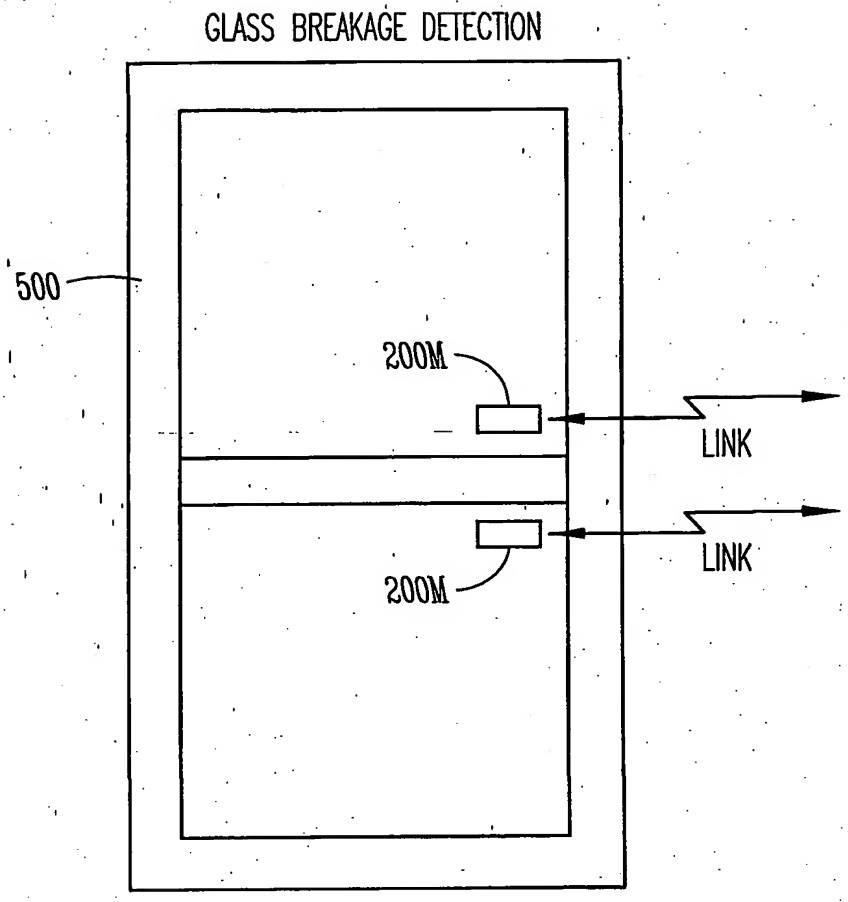


Fig. 14

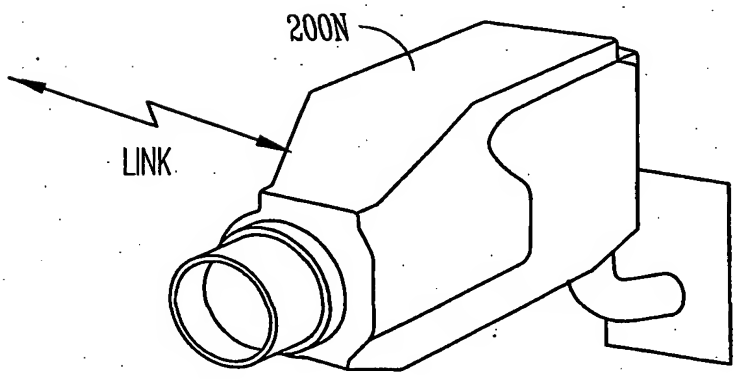


Fig. 15

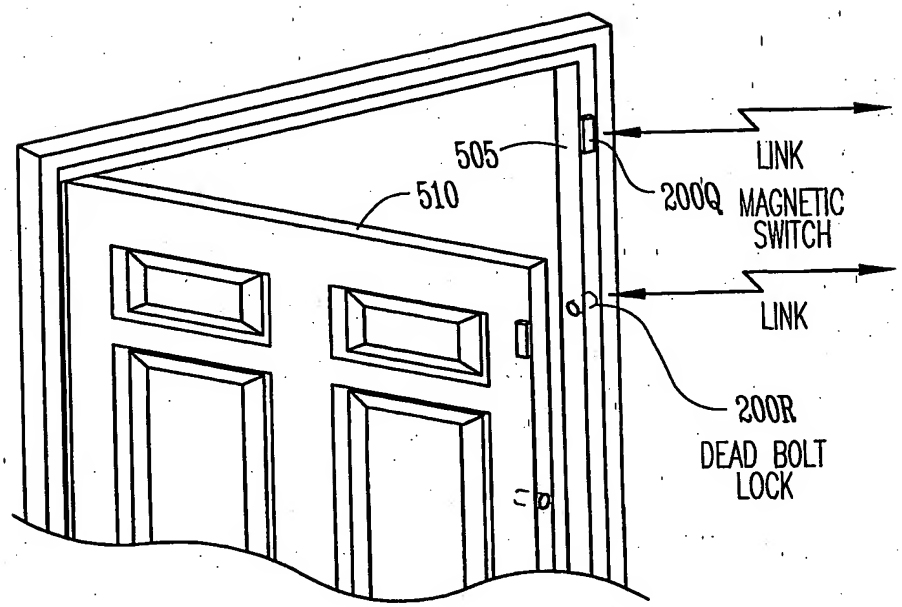


Fig. 16

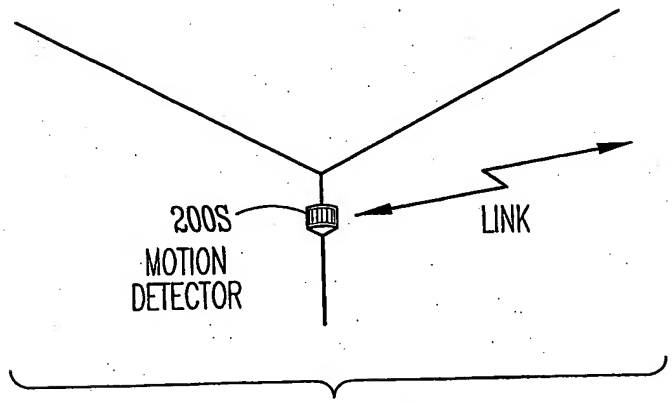


Fig. 17

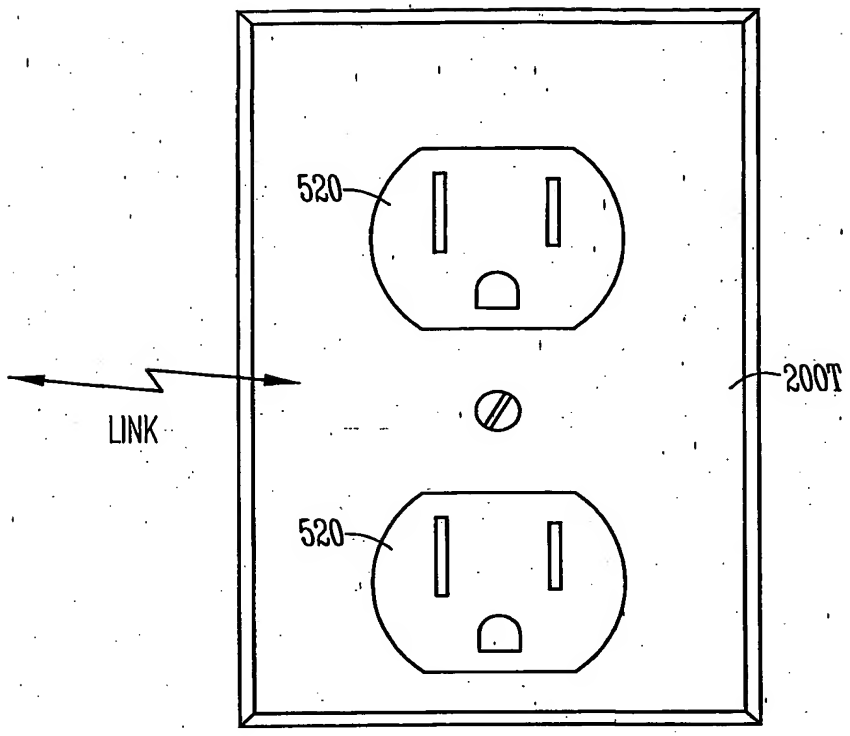


Fig. 18

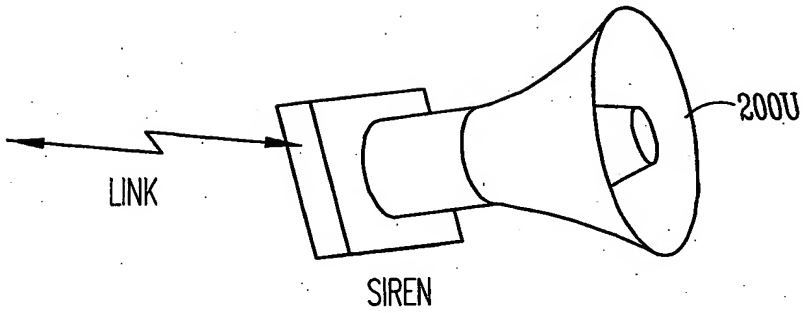


Fig. 19

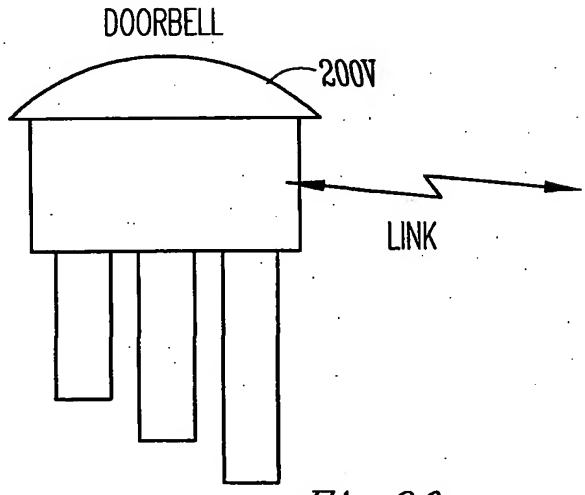


Fig. 20

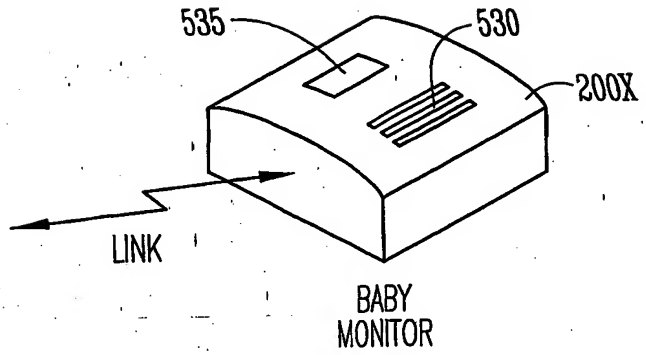


Fig.21

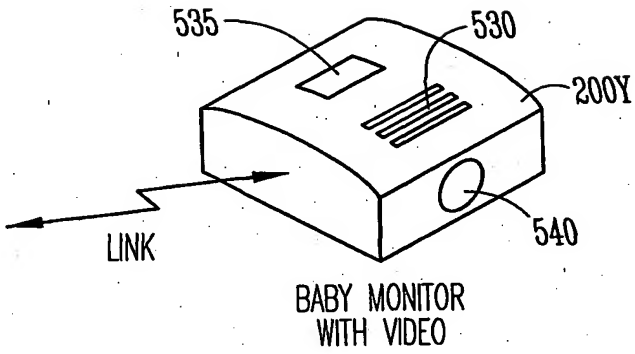


Fig.22

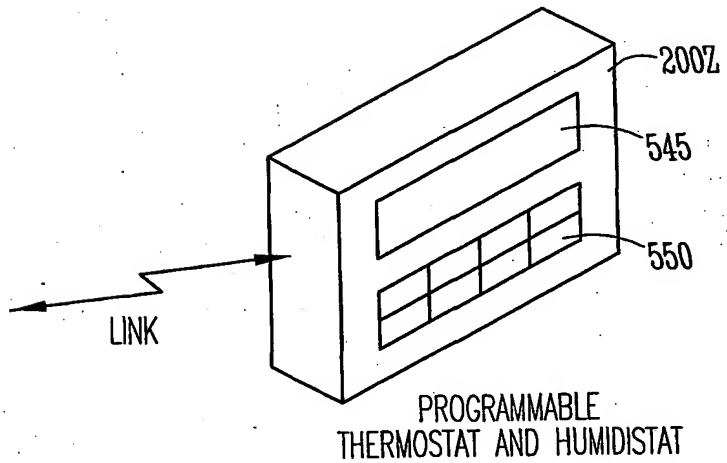


Fig.23

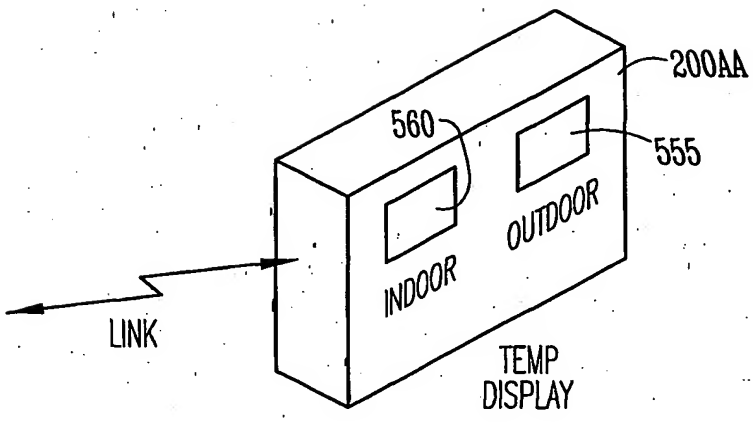


Fig.24

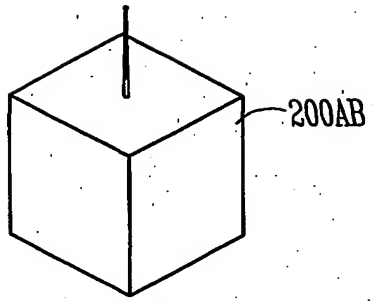


Fig.25

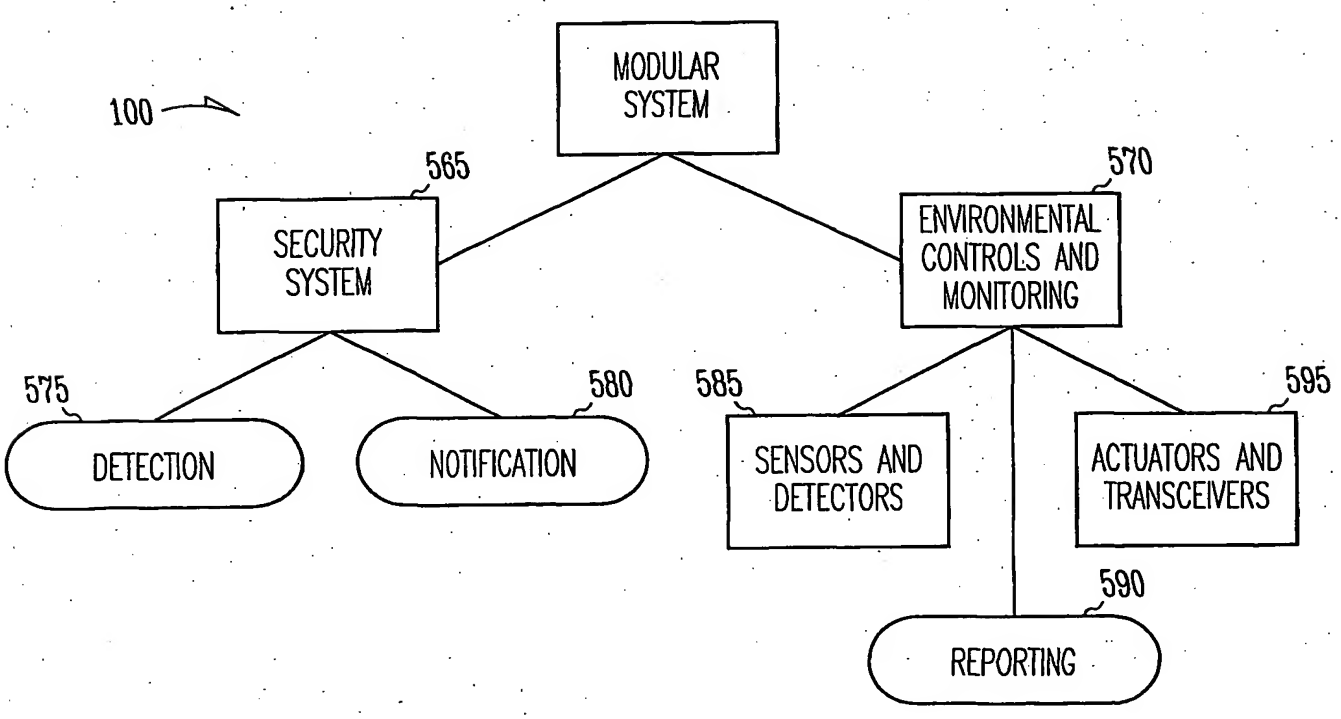


Fig.26

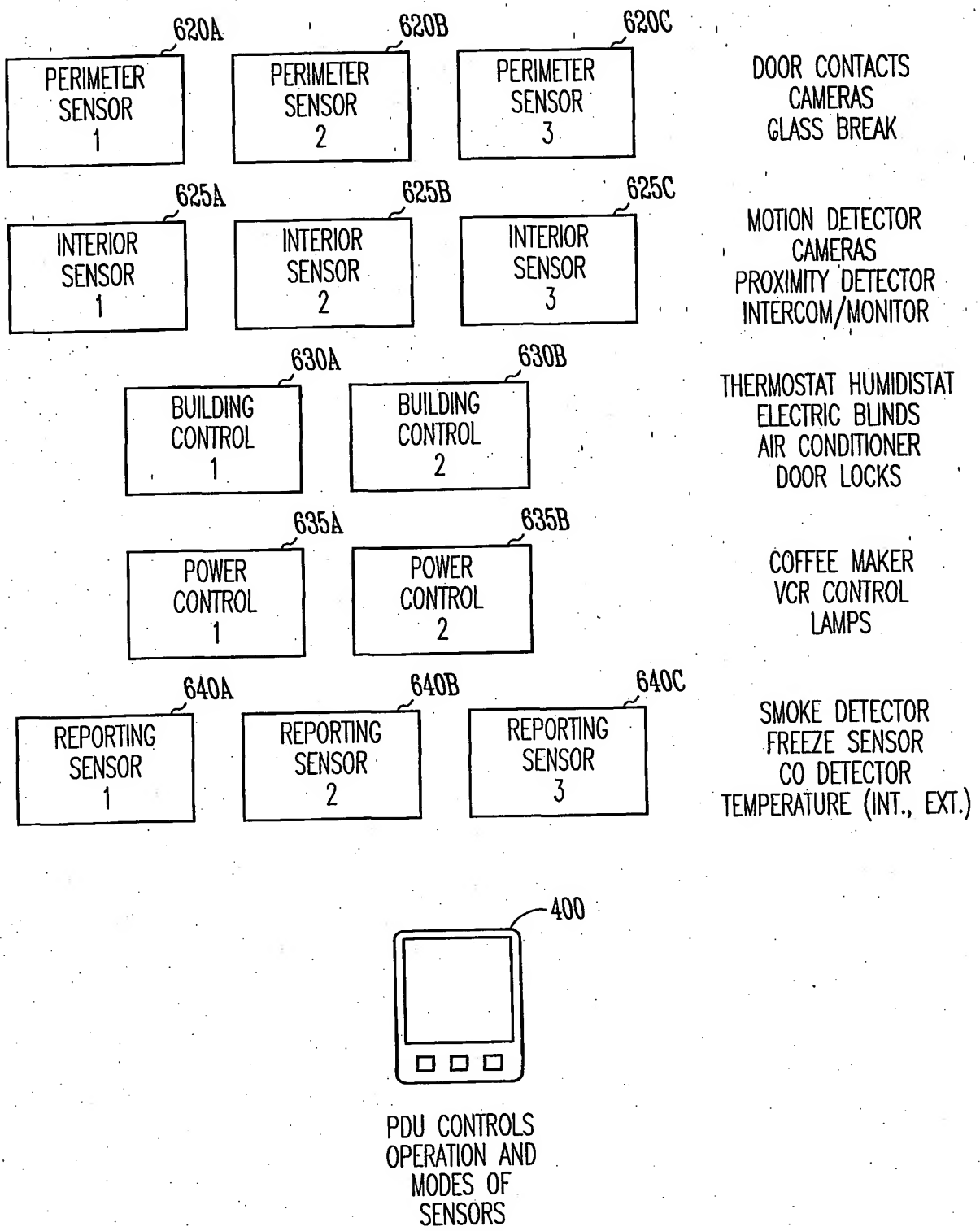


Fig. 27

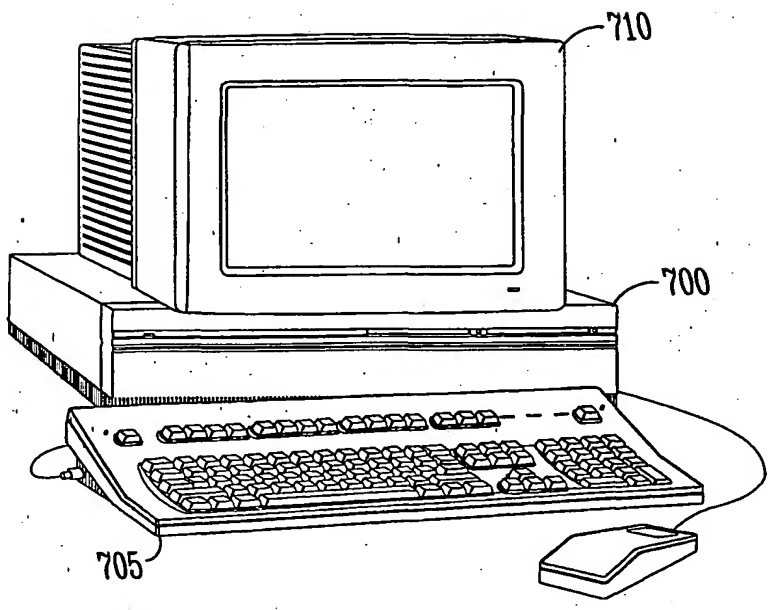


Fig.28

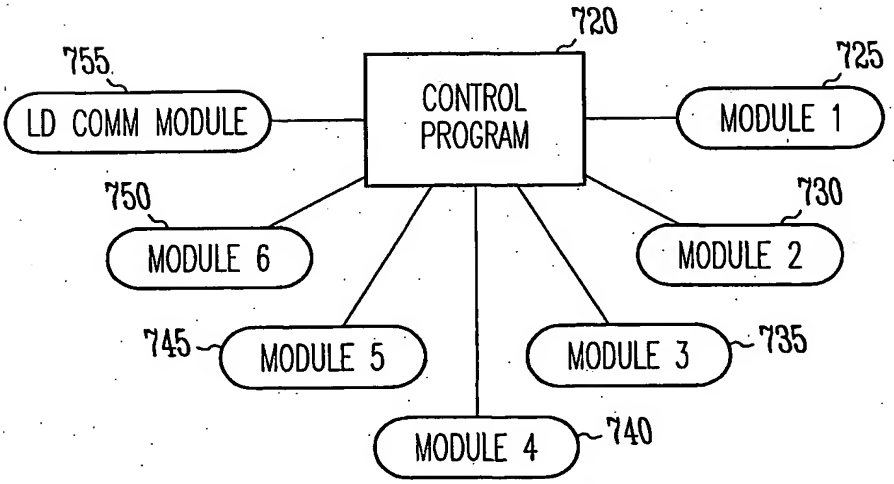


Fig.29

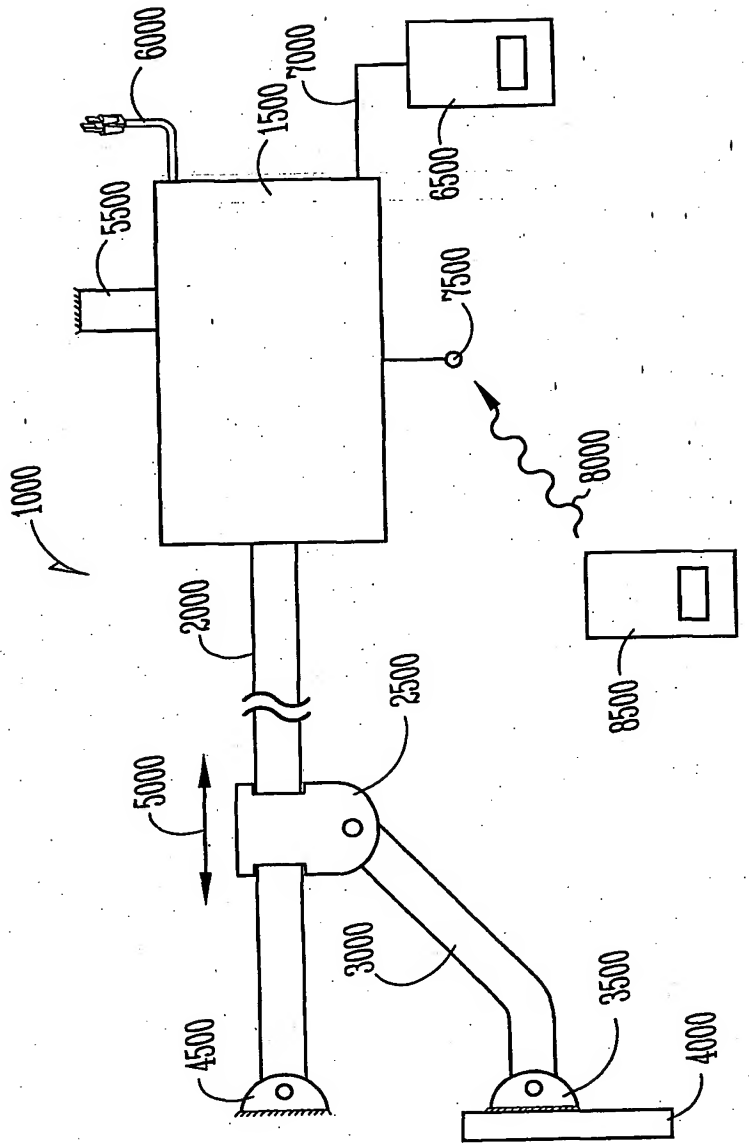


Fig. 30

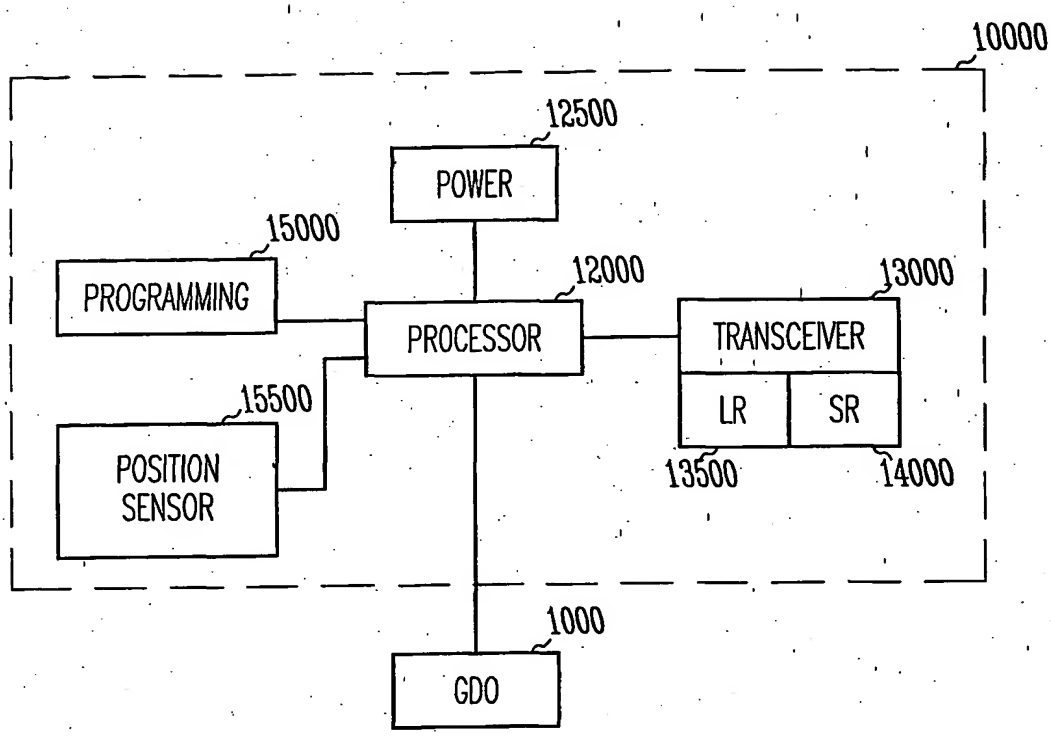


Fig. 31

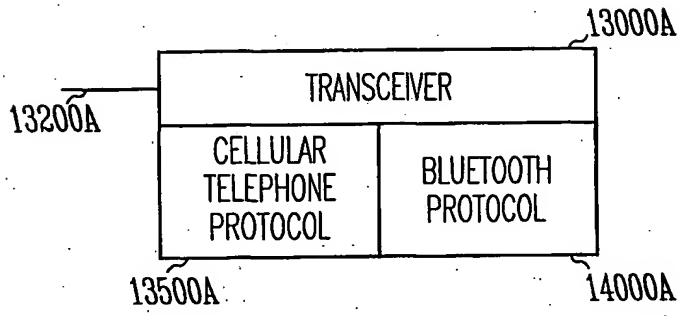


Fig. 32

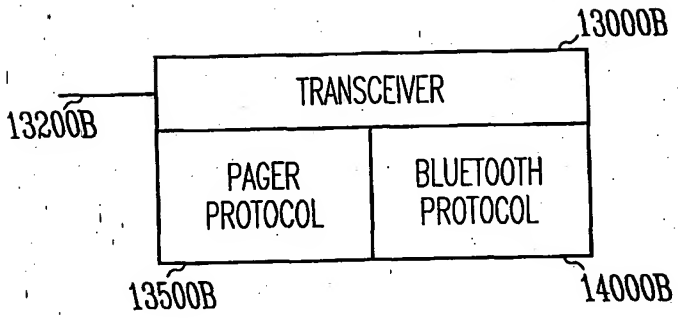


Fig. 33

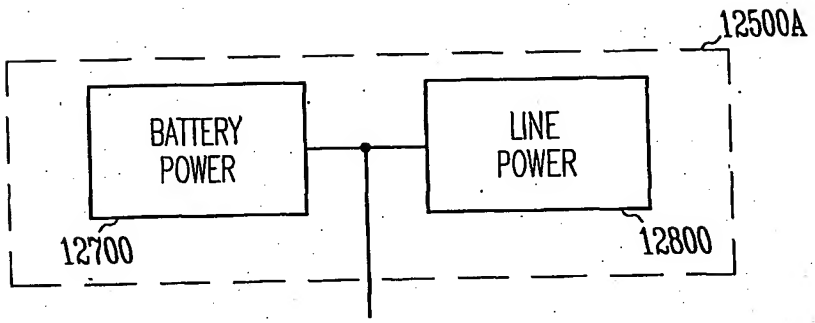


Fig. 34

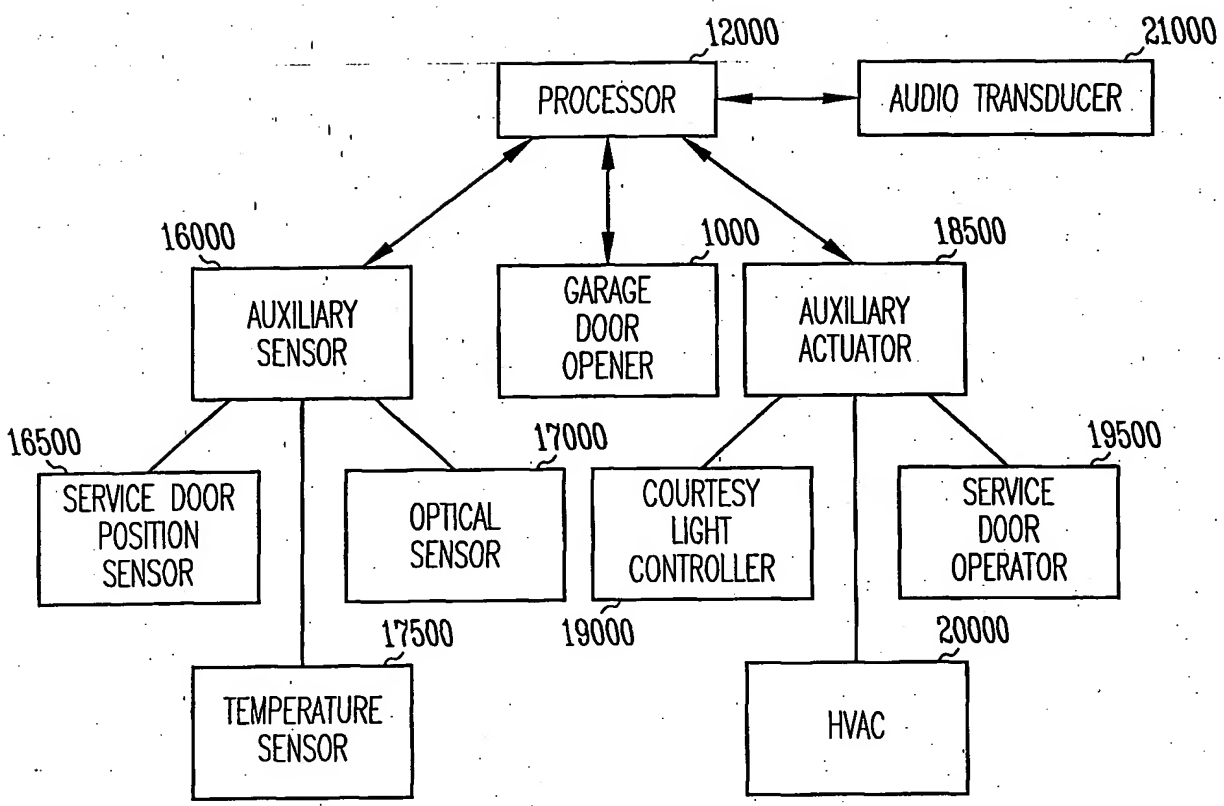


Fig. 35

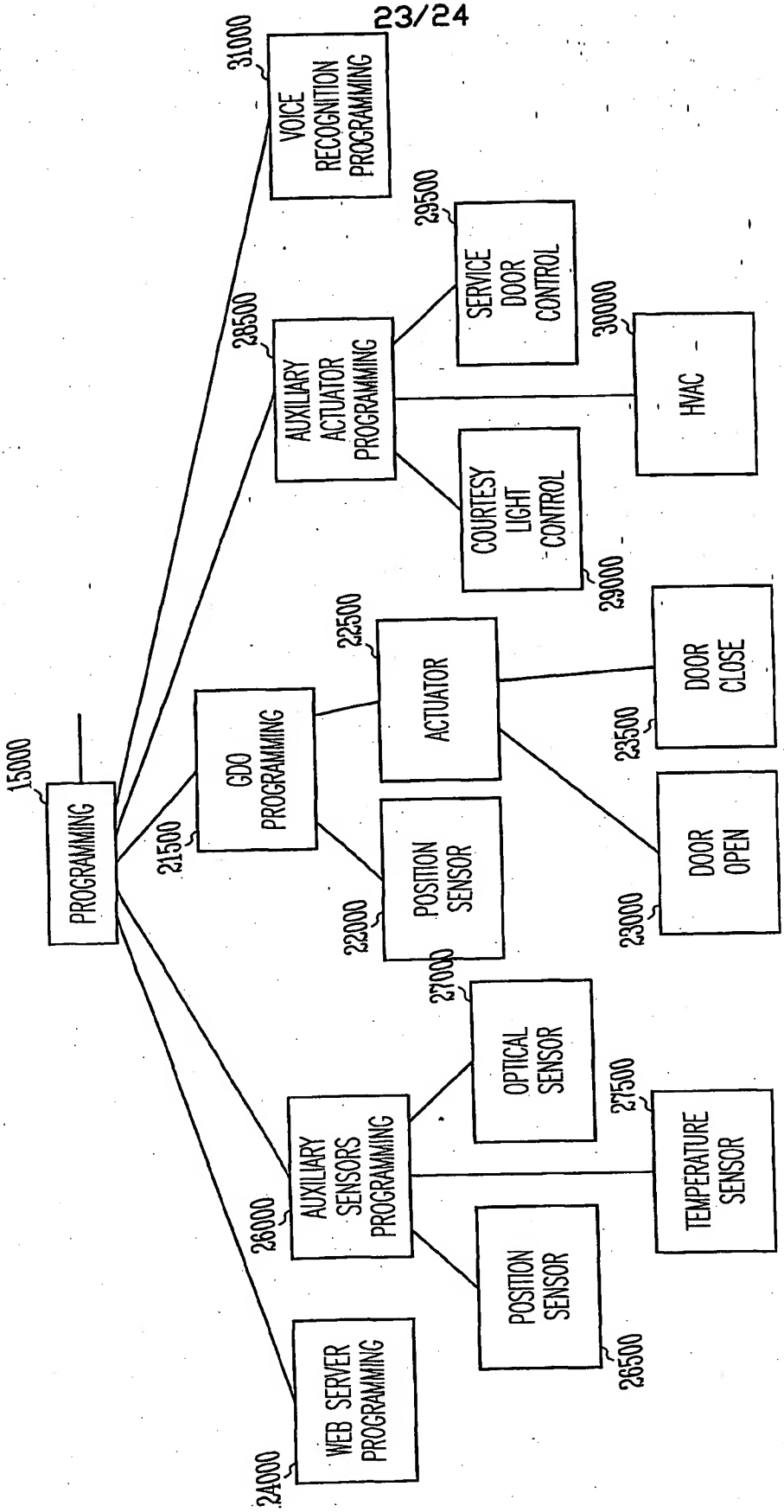


Fig. 36

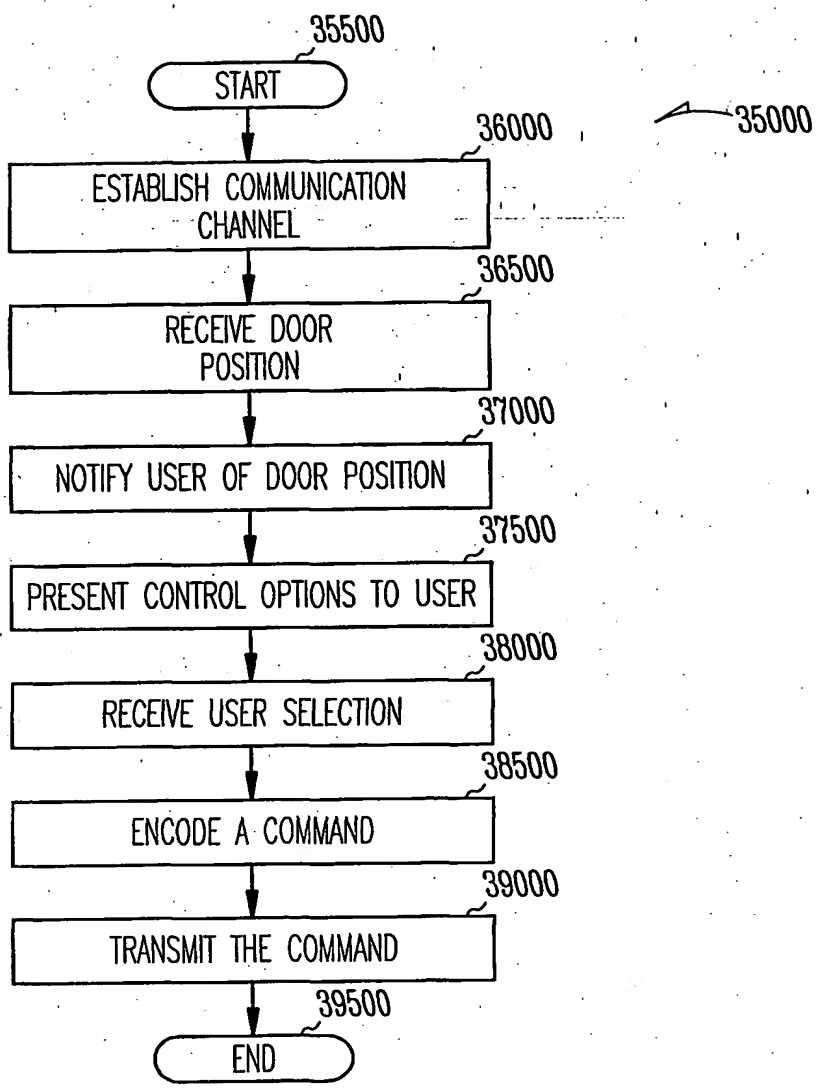


Fig. 37

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/17300

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :G08B 1/08
US CL :340/539,426,425.5,457,825.32,825.36,825.37,825.49
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 340/539,426,425.5,457,825.32,825.36,825.37,825.49

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,917,405 A (JOAO) 29 June 1999, abstract, lines 1-15	1-103

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 01 JULY 2001	Date of mailing of the international search report 30 OCT 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer DARYL C. POPE Telephone No. (703) 305-4838

Form PCT/ISA/210 (second sheet) (July 1998)★